

## Diagnostic Loop Overview

Flowchart illustrating the Diagnostic Loop Overview.

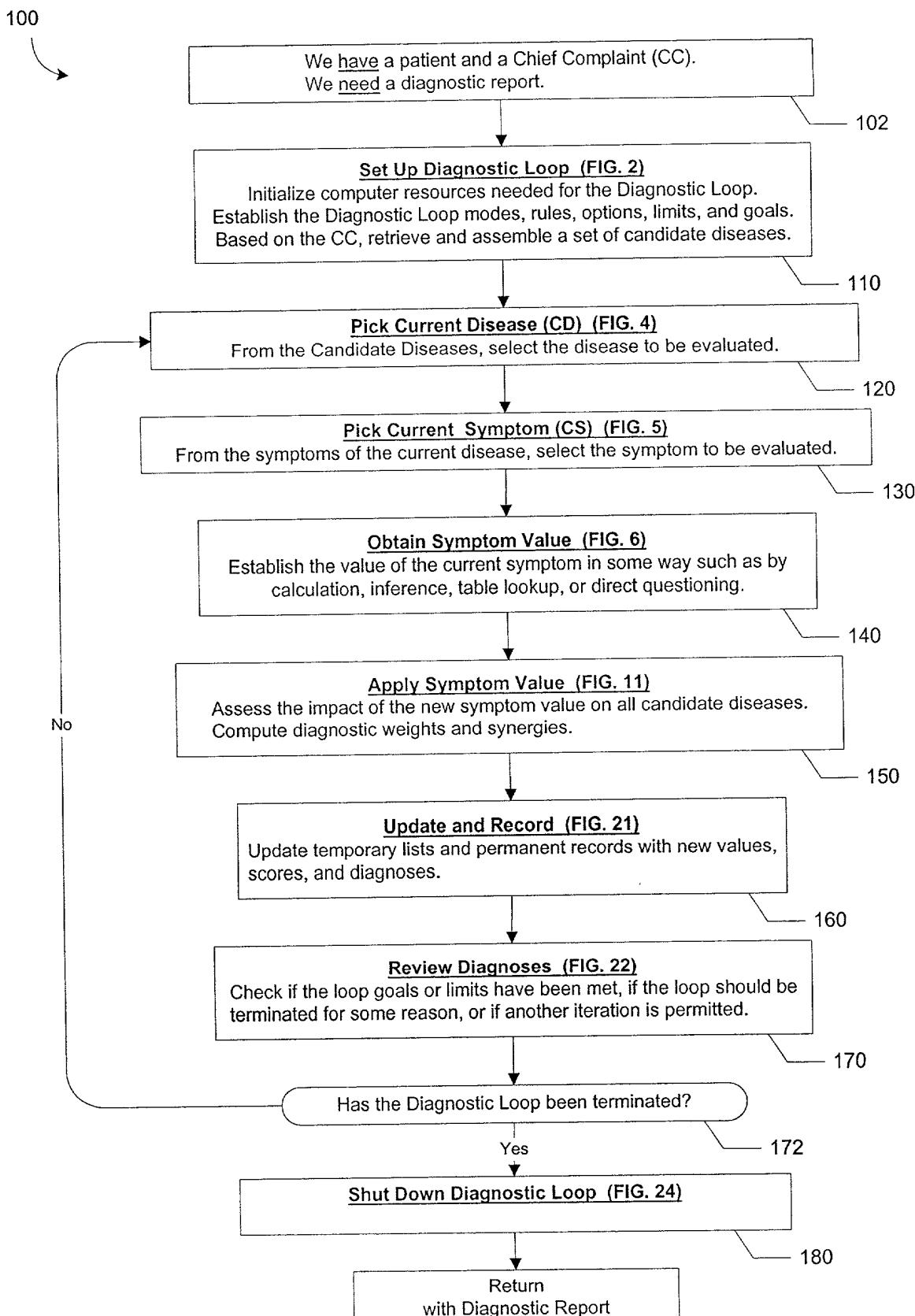


FIG. 1

## Set Up Diagnostic Loop

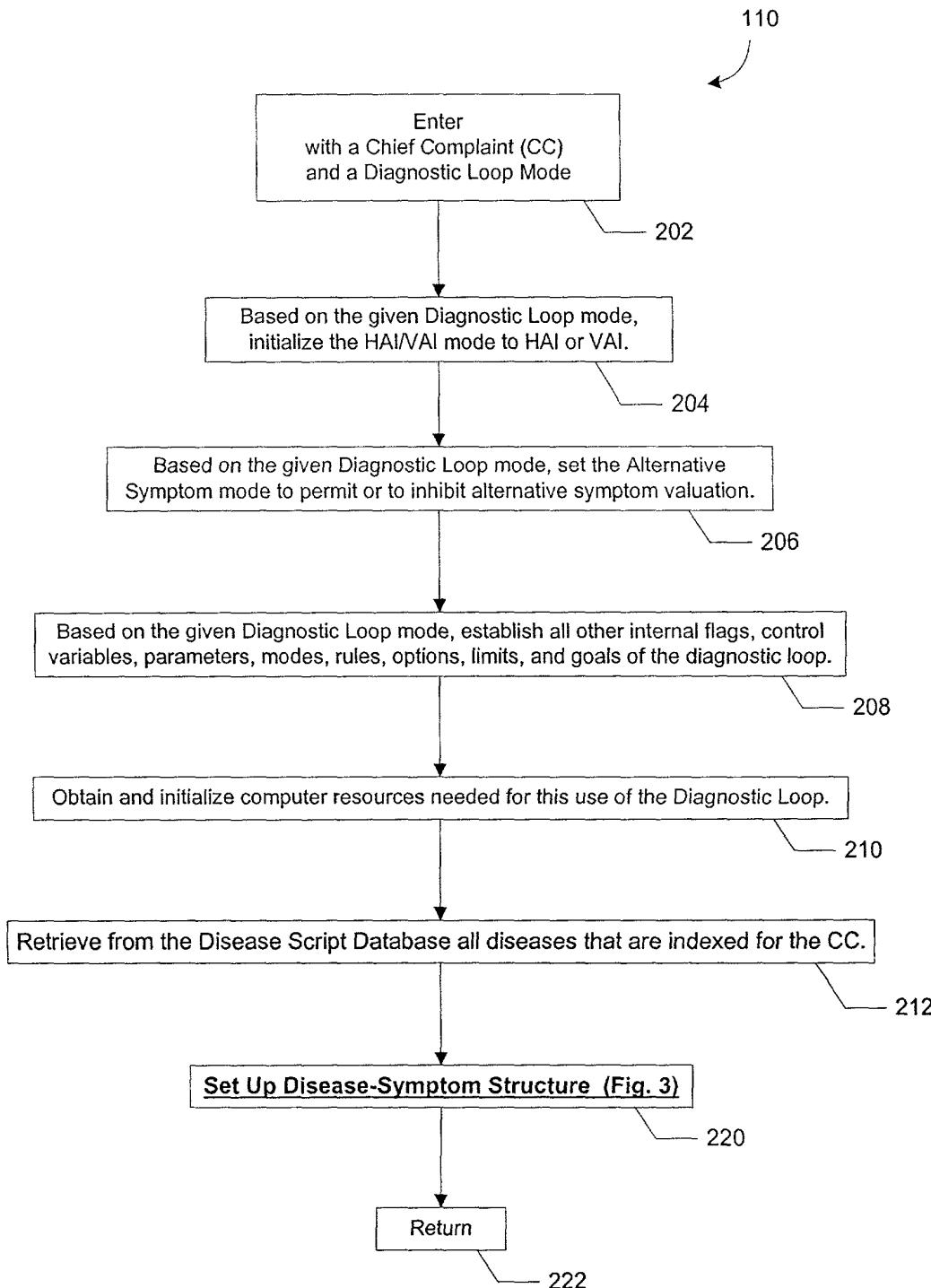


FIG. 2

## Set Up Disease-Symptom Structure

220

Enter

302

Create a Disease-Symptom Structure, such as a Disease-Symptom Cube (DSC), with columns for all the diseases selected by the CCI, rows for the maximum number of symptoms used by all diseases, and time slices (Z-axis) for the time intervals used by the diseases.

304

From the selected diseases, extract all diseases marked 'urgent' and sort these by decreasing urgency.

306

Place the most urgent disease as the leftmost column of a Disease-Symptom Matrix (DSM) [the DSC at one time slice].

308

Place the remaining urgent diseases in the next columns of the DSM.

310

From the selected diseases, extract all diseases marked 'serious' and sort these by decreasing seriousness.  
Place the most serious disease as the next available leftmost column of the DSM, next to the urgent diseases.  
Place the remaining serious diseases into the next columns of the DSM.

312

Sort the remaining selected diseases by decreasing prevalence (i.e., decreasing probability of occurrence of the disease in the population from which the patient comes).  
Place the remaining diseases in order of decreasing prevalence as the next available leftmost column of the DSM, next to the serious diseases.

314

Return

316

FIG. 3

120

### Pick Current Disease

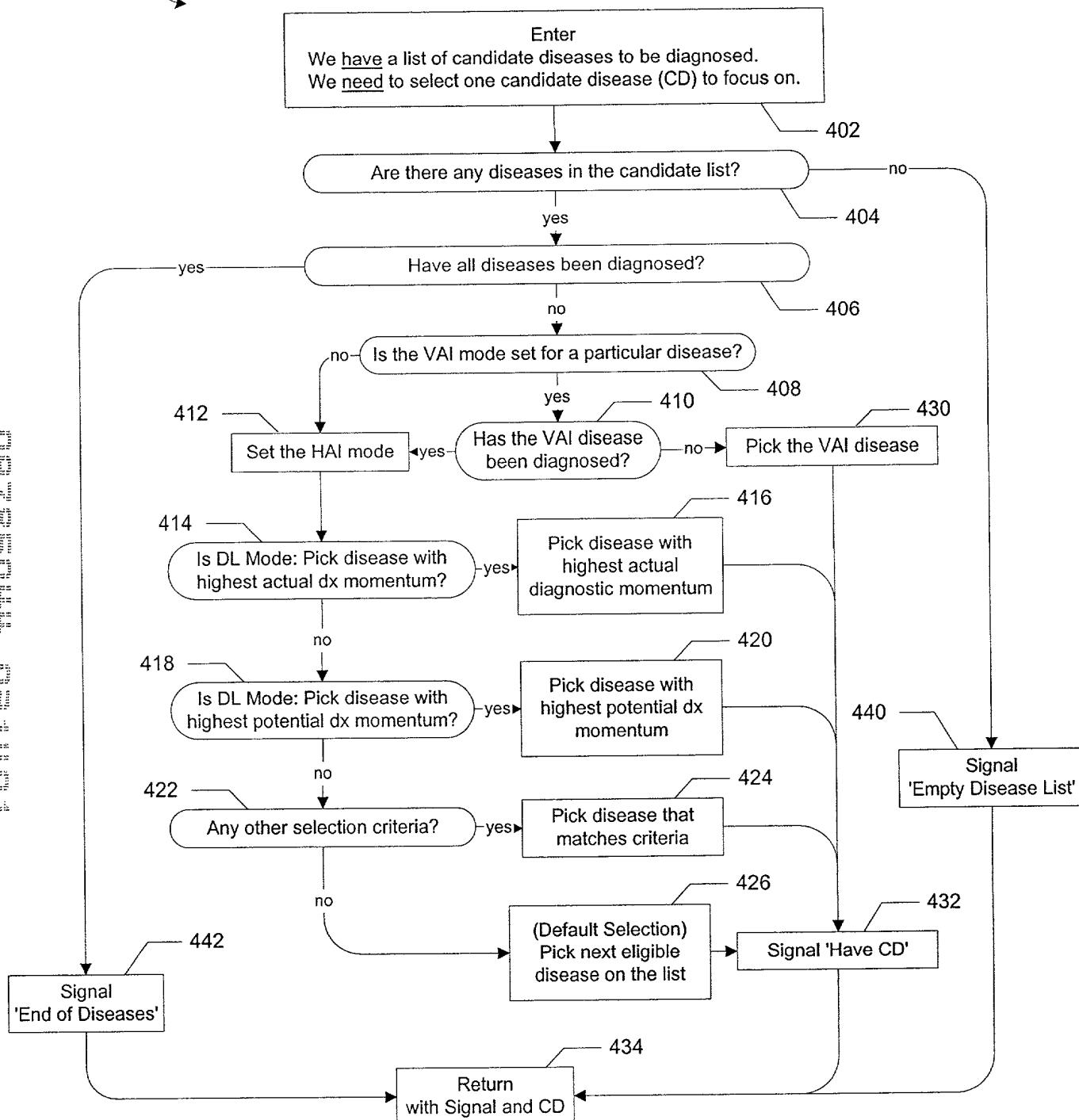


FIG. 4

### Pick Current Symptom

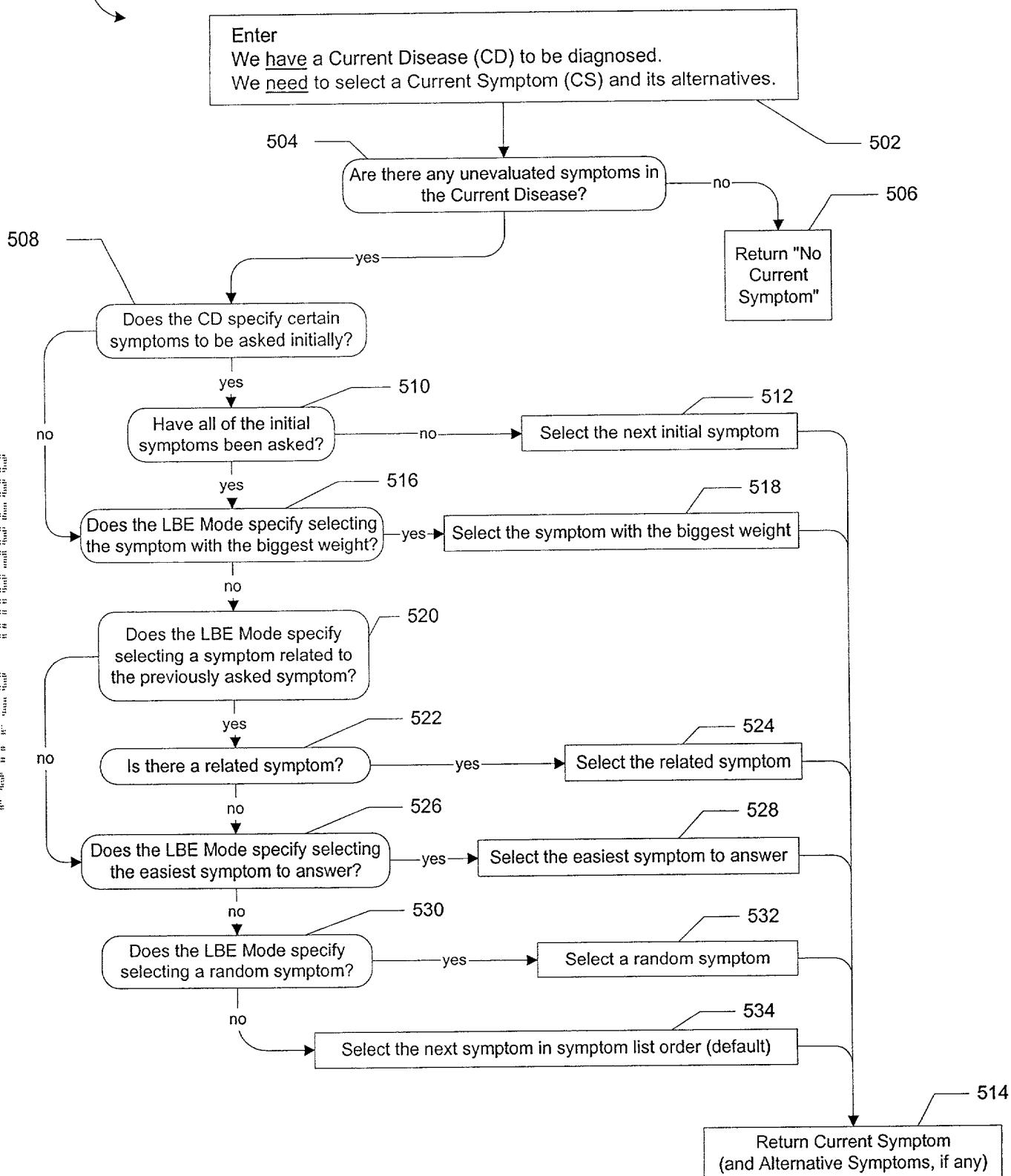


FIG. 5

## Obtain Symptom Value

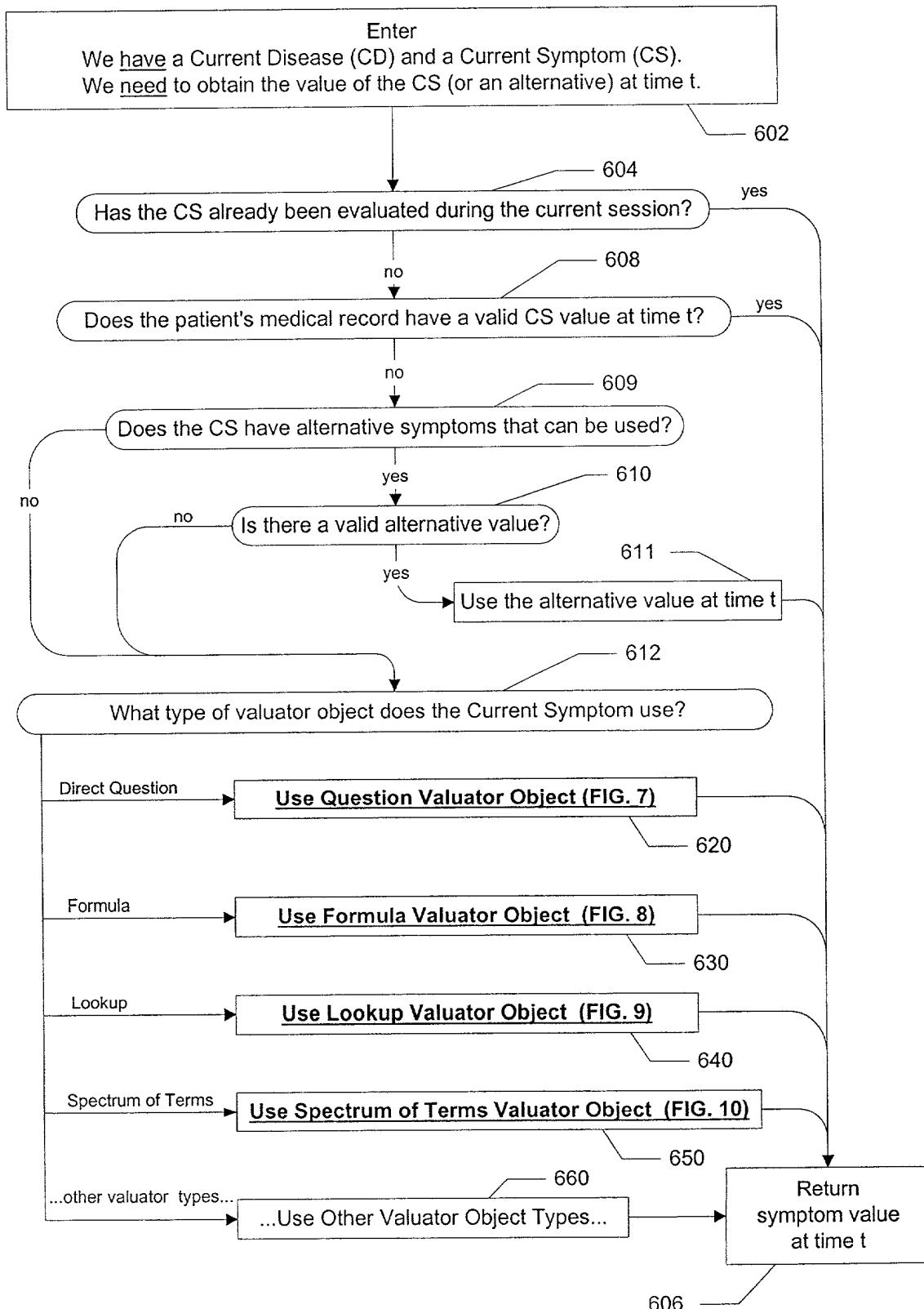


FIG. 6

620

## Use Question Valuator Object

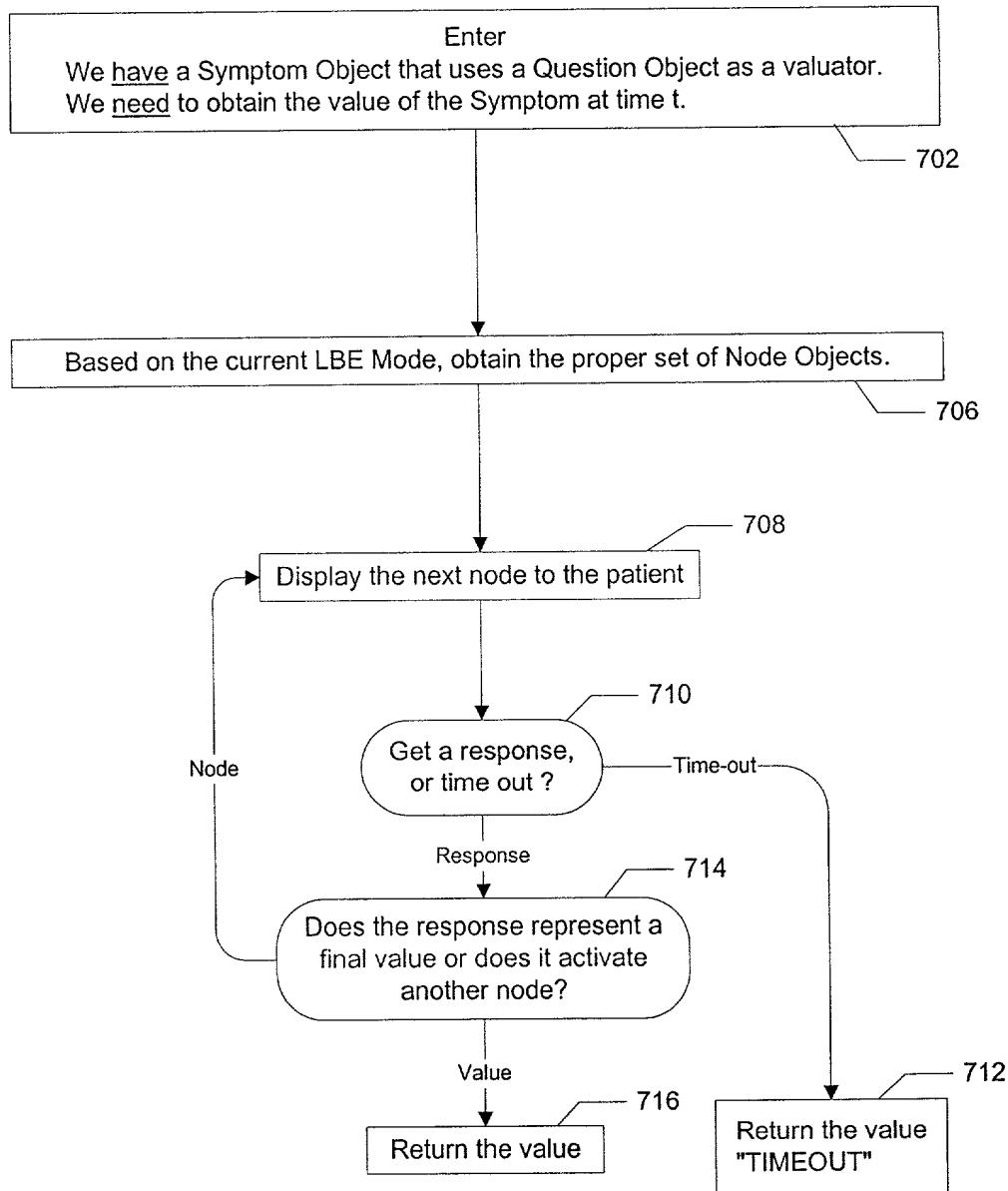


FIG. 7

### Use Formula Valuator Object

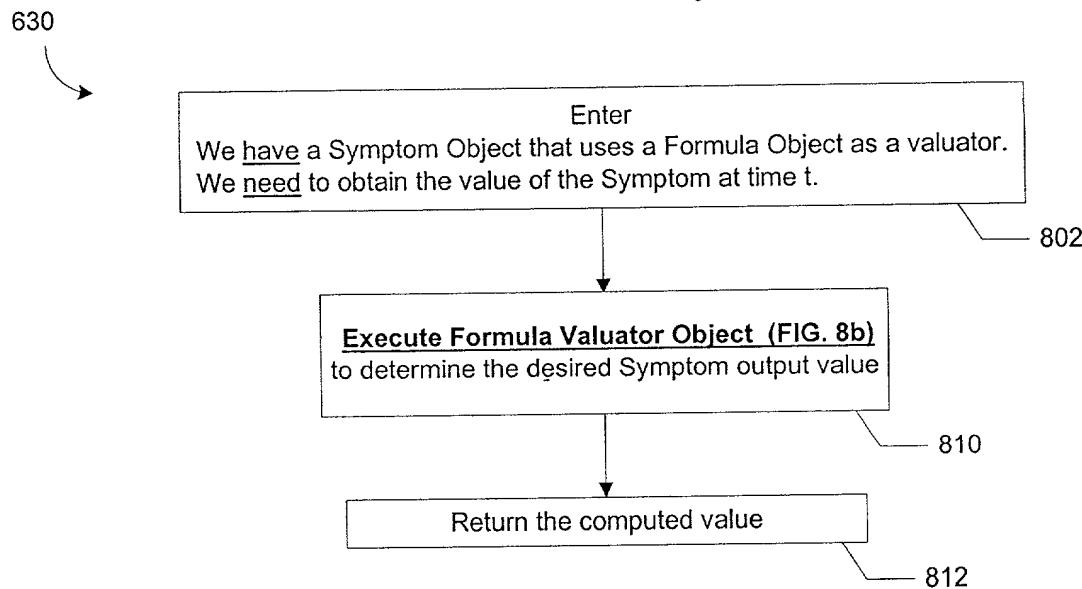


FIG. 8a

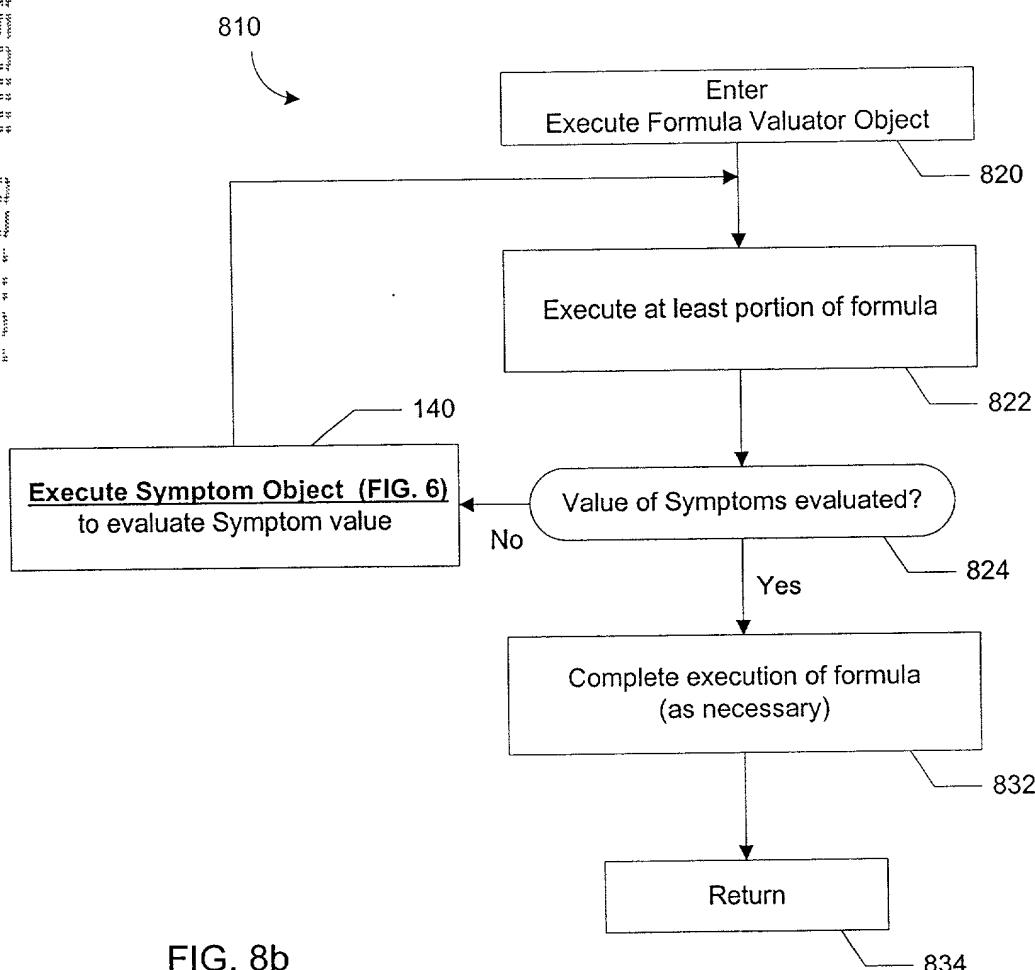


FIG. 8b

640

## Use Lookup Valuator Object

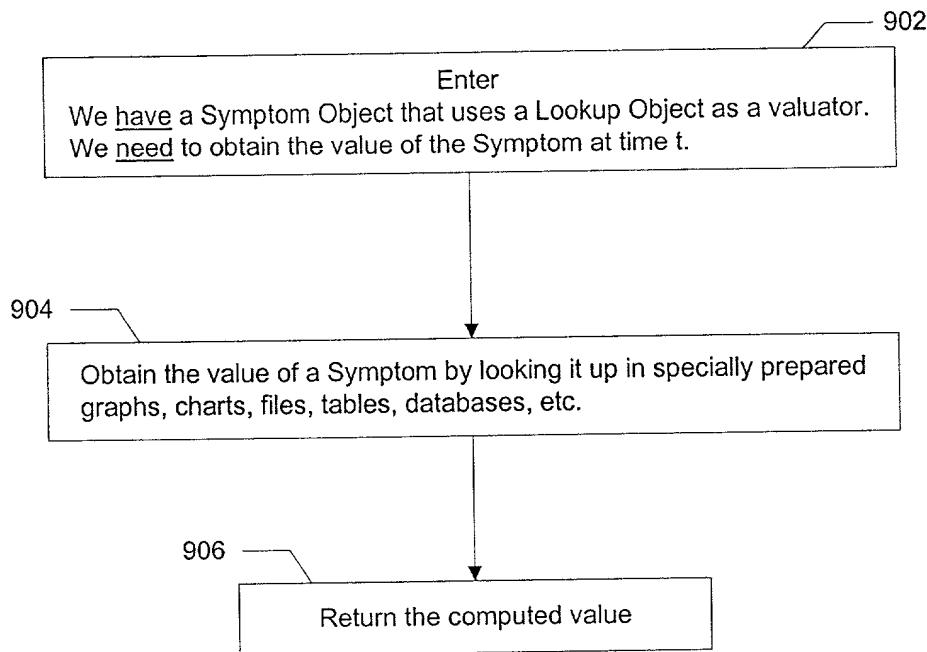


FIG. 9

## Use Spectrum of Terms Valuator Object

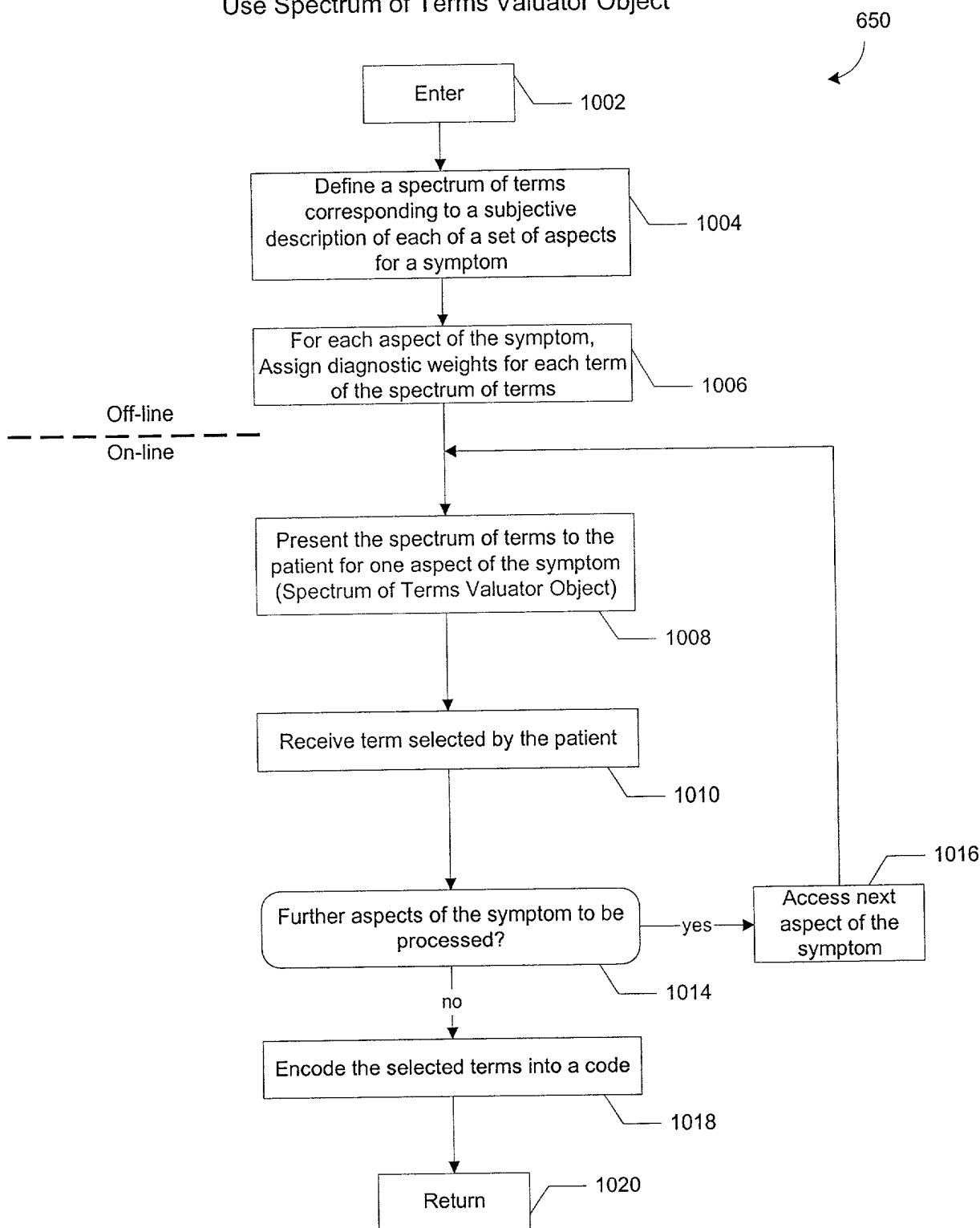


FIG. 10

## Apply Symptom Value

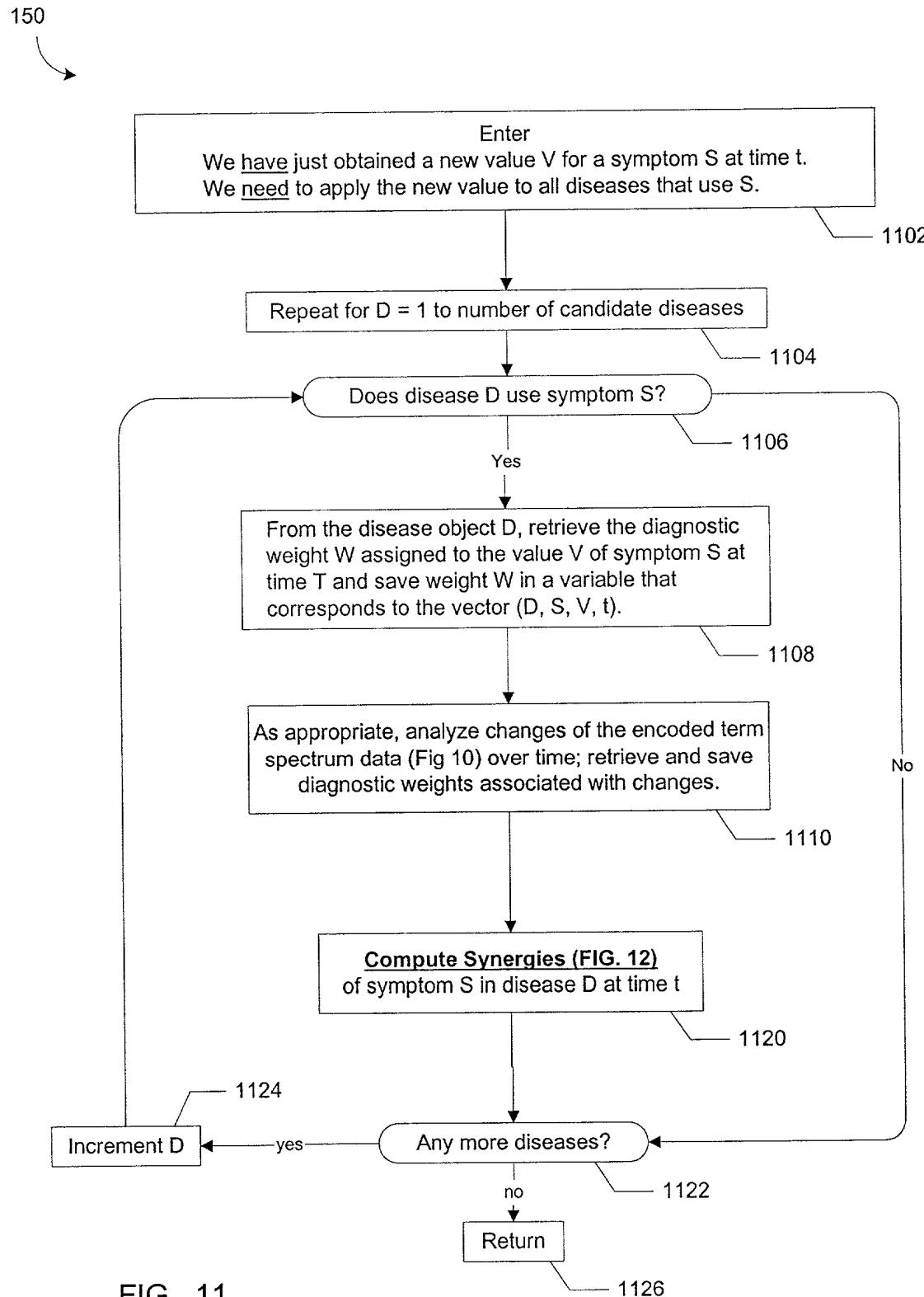


FIG. 11

1120

## Compute Synergies

Enter

We have a new value V at time t, for a symptom S of a disease D.  
 We need to review all synergies and recalculate any synergy weight changes for D.

1202

Has the author defined any synergies for disease D?

yes

no

Repeat for i = 1 to the number of synergies defined for disease D

1208

Return

1206

What is the type of synergy i?

1210

First Sig. Symptom Synergy

Calculate FSS Synergy (FIG.13)

1220

Onset [Offset] Synergy

Calculate Onset [Offset] Synergy (FIG. 14)

1230

Sequencing Synergy

Calculate Sequencing Synergy (FIG. 18)

1240

Simultaneous Synergy

Calculate Simult. Synergy (FIG. 19)

1250

Time Profile Synergy

Calculate Time Profile Synergy (FIG. 20)

1260

... other synergies ...

...calculate other synergies...

1270

1274

yes

Any more synergies?

1272

Return

no

1276

FIG. 12

## Calculate First Significant Symptom (FSS) Synergy

1220

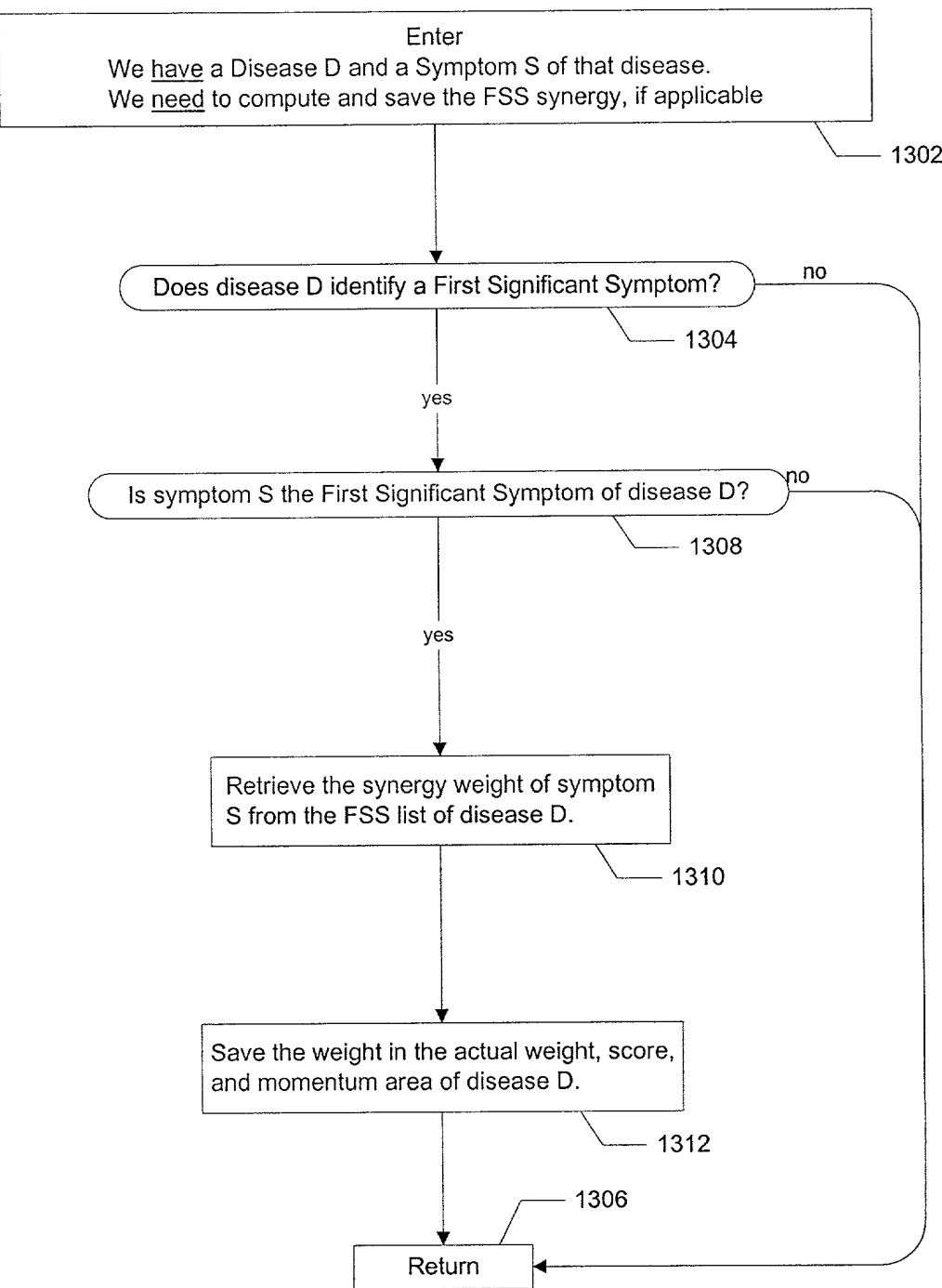


FIG. 13

## Calculate Onset [Offset] Synergy

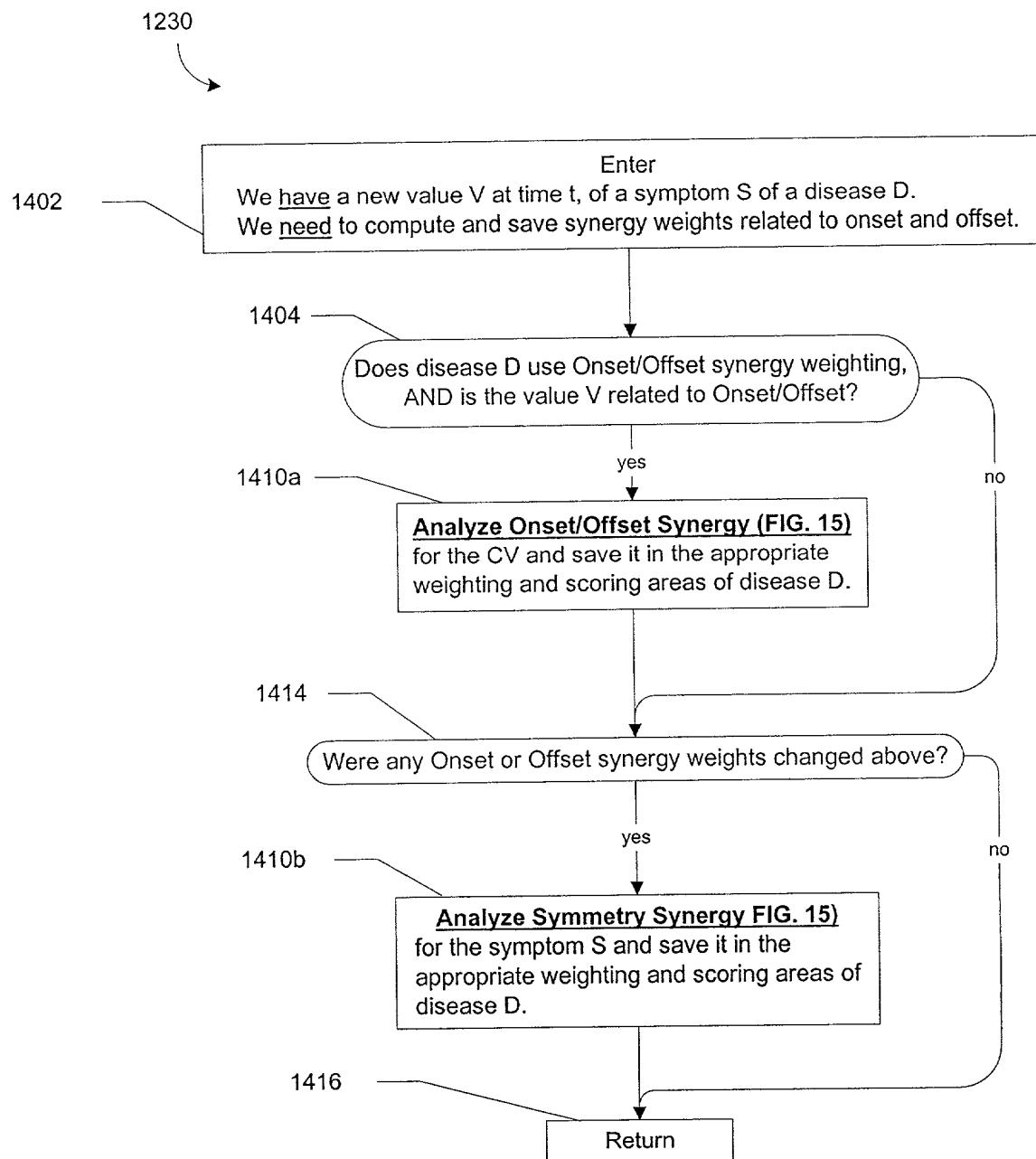


FIG. 14

## Analyze Onset [Offset] Synergy

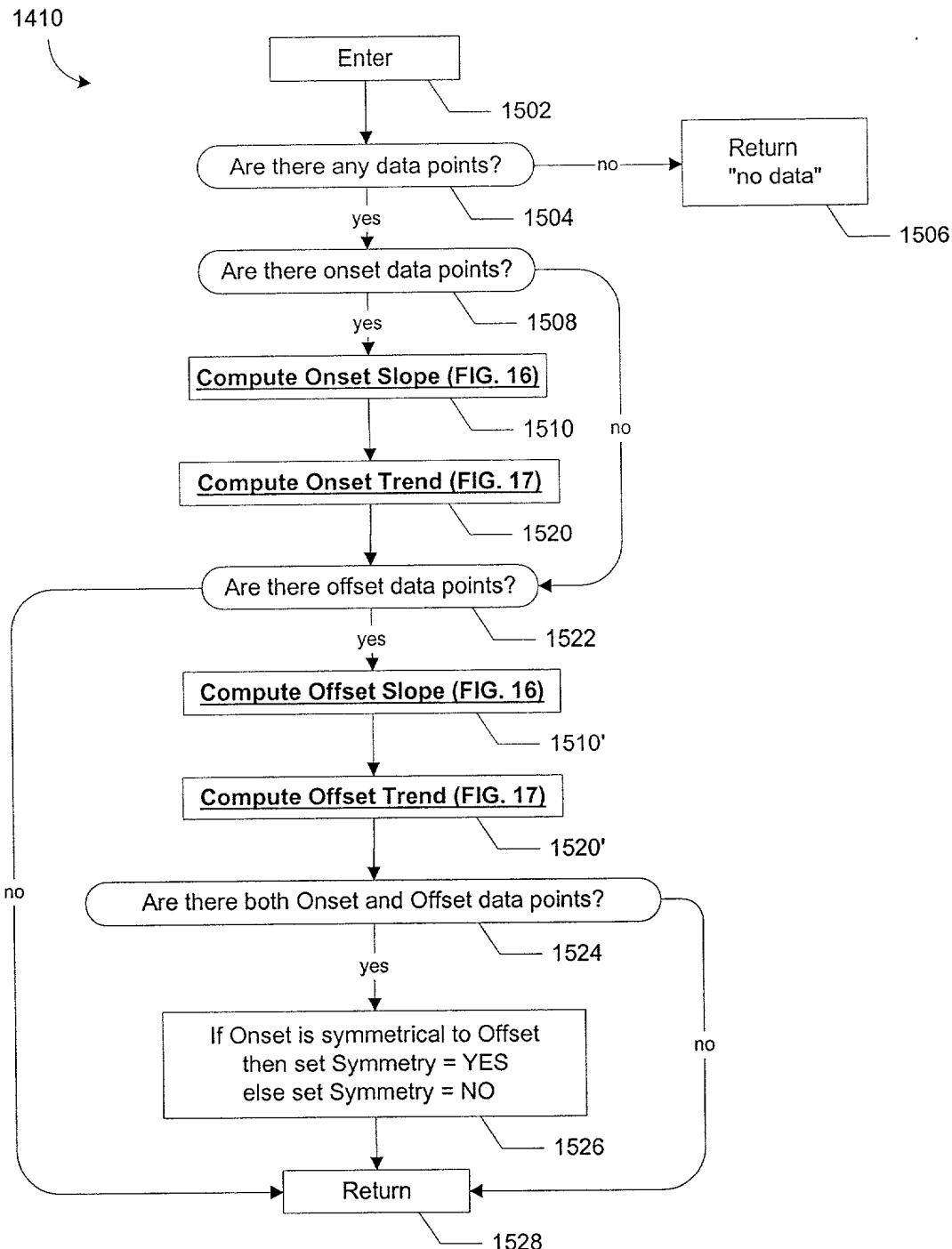


FIG. 15

## Compute Onset [Offset] Slope

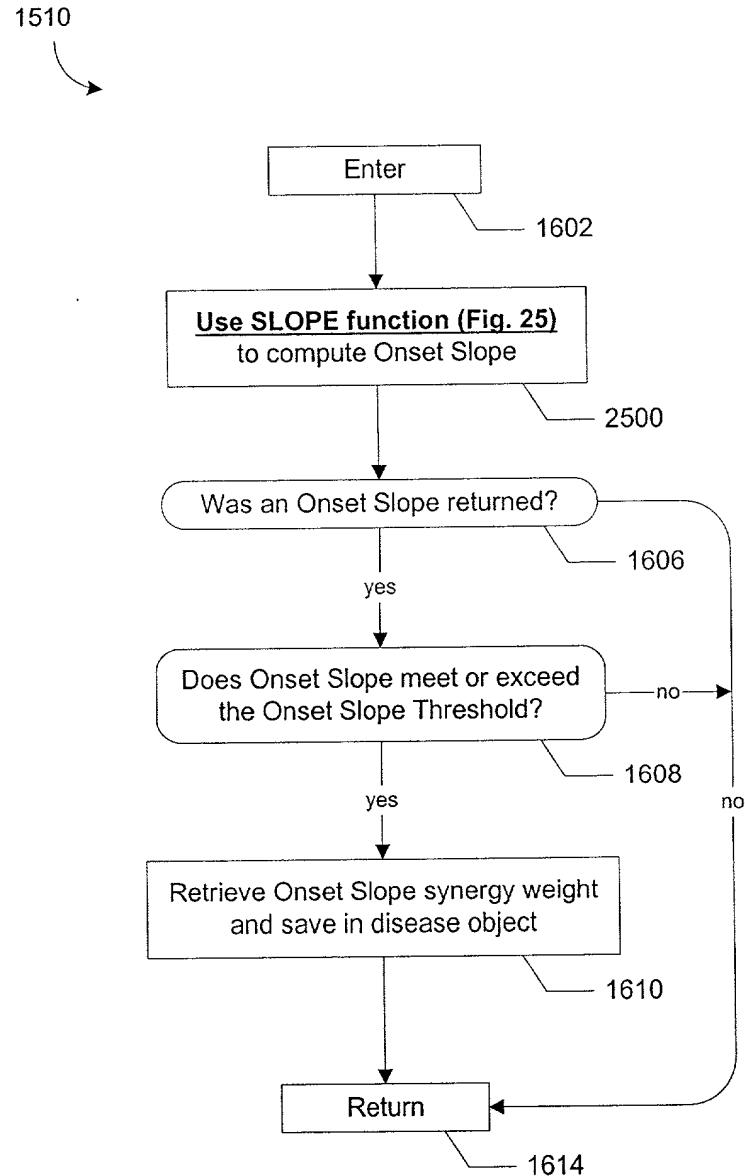


FIG. 16

## Compute Onset [Offset] Trend

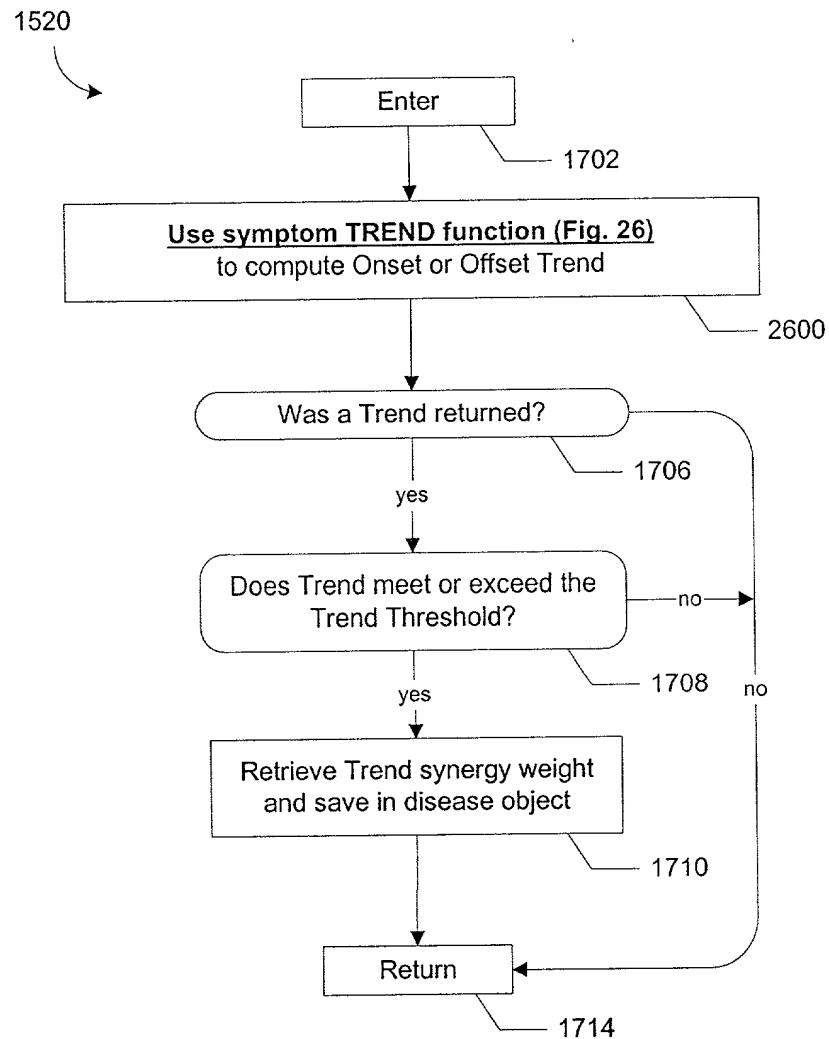


FIG. 17

1240

## Calculate Sequence Synergy

**Enter**  
 We have a new value V at time t, for a symptom S of a disease D.  
 We need to compute and save sequence synergy weights (if any) in disease D.

Does disease D use Sequence Synergy weighting?

yes

Retrieve the symptoms that are involved in Sequence Synergy from the disease D object.

1802

1804

1806

Compare the symptom sequence specified by the author to the actual symptoms sequence in the patient.

1808

no

Does the patient's symptom sequence match the author's synergy sequence?

yes

no

Retrieve the corresponding synergy weights.  
 Save them in the appropriate weight and score areas of disease D.

1810

1812

Return

1814

FIG. 18

## Calculate Simultaneous Synergy

1250

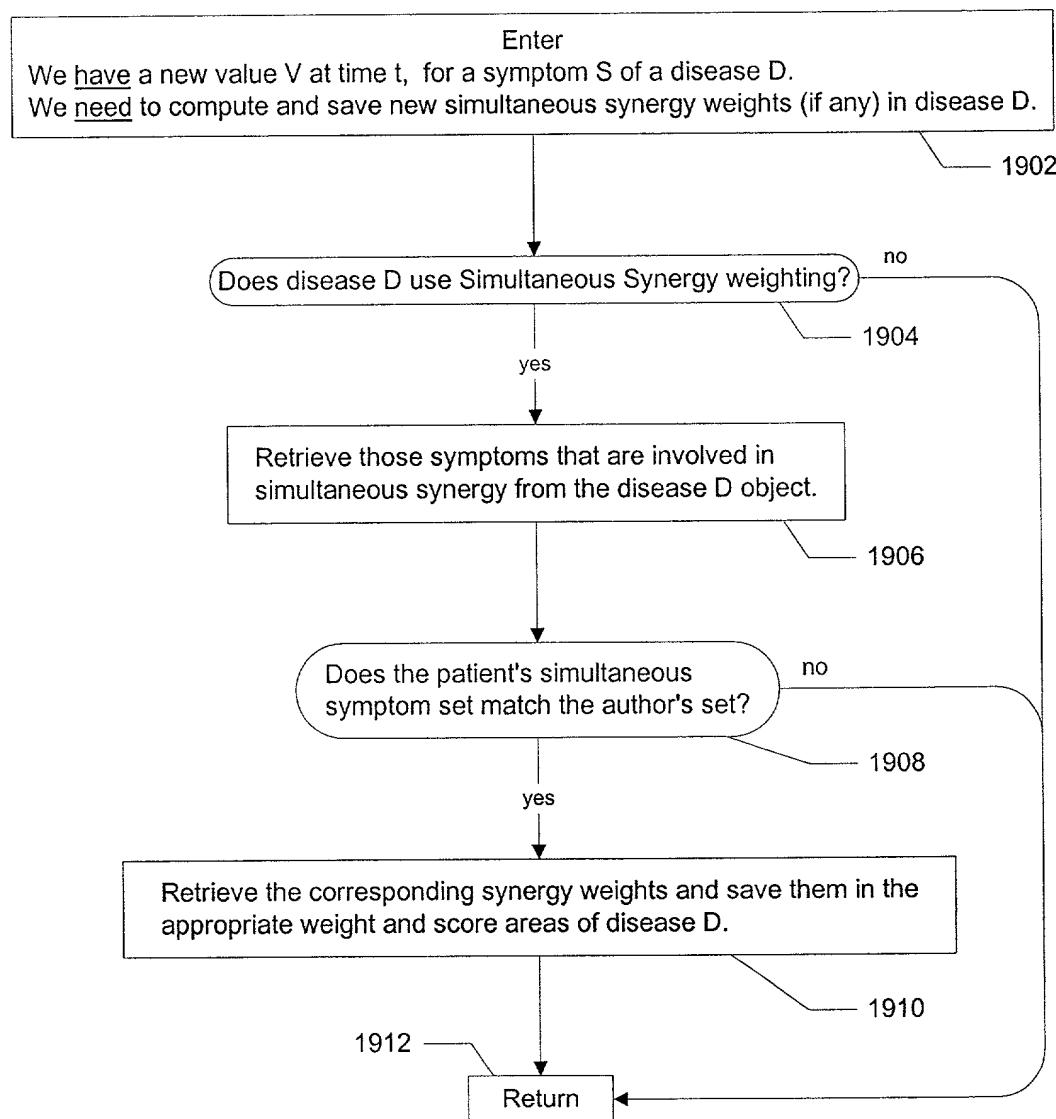


FIG. 19

## Calculate Timeline Profile Synergy

1260

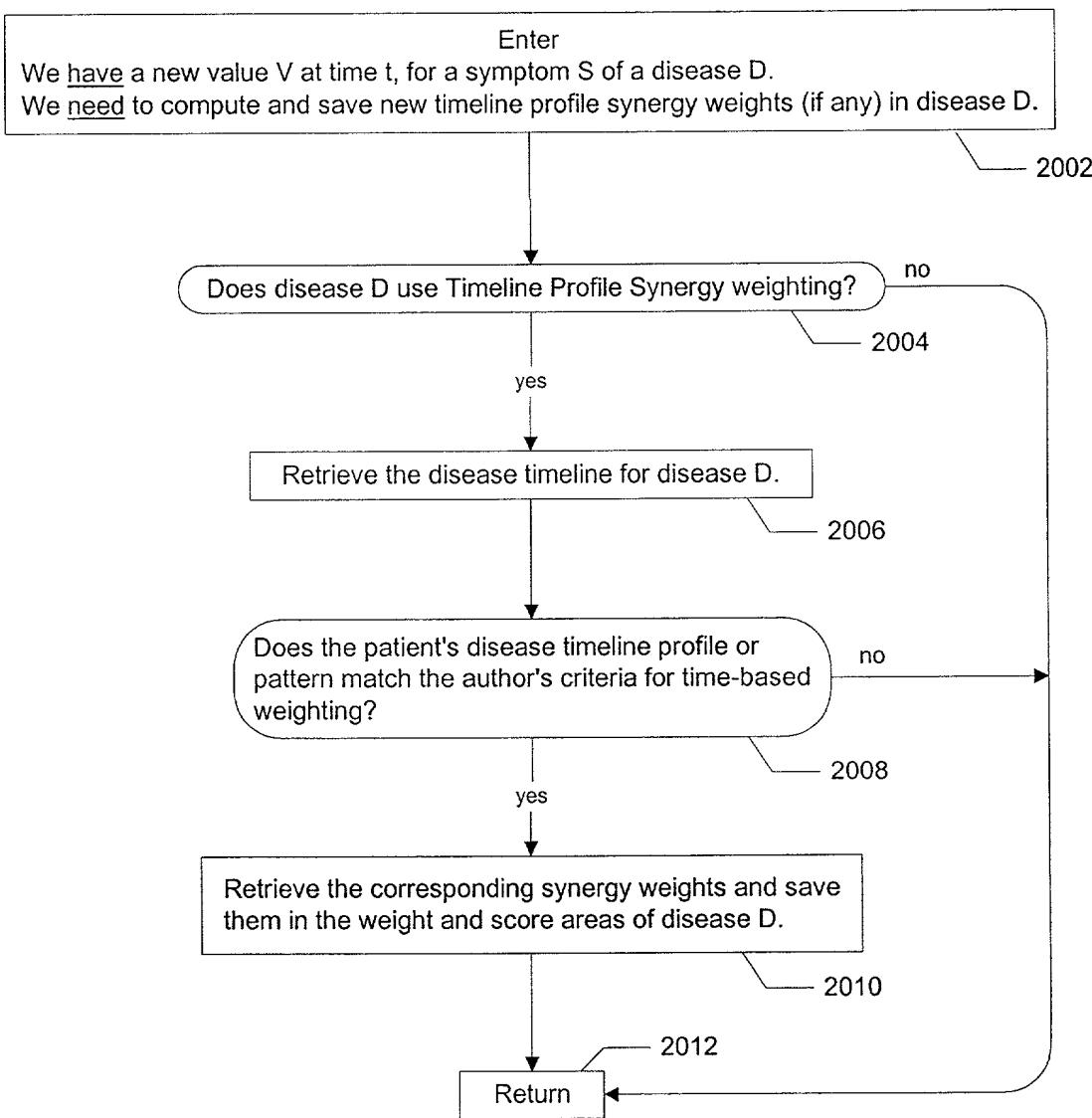


FIG. 20

### Update and Record

We have established new weights for all diseases that use the Current Symptom CS. We need to update the diagnostic score and momentum of these diseases, and prepare for another iteration of the diagnostic loop.

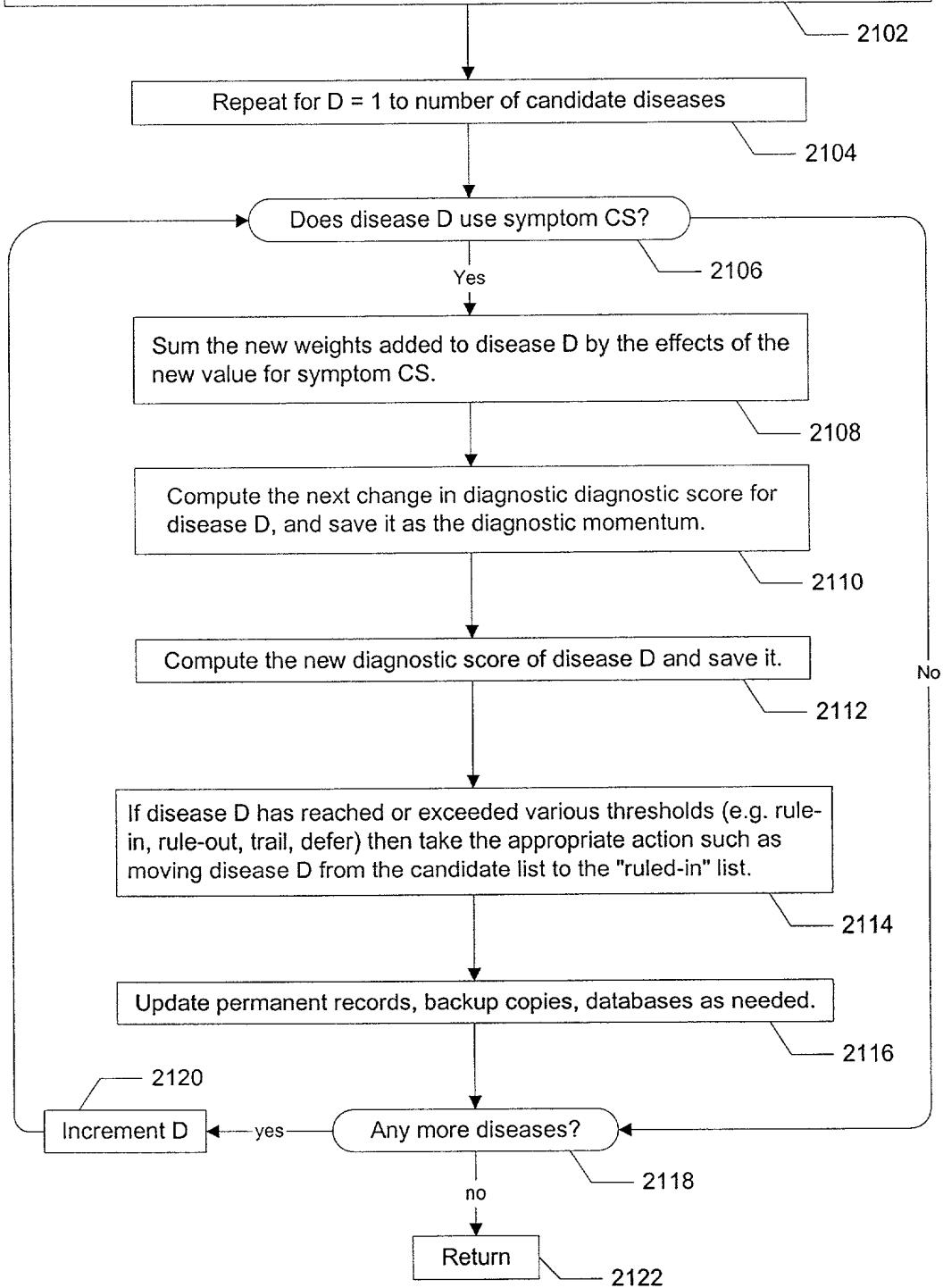


FIG. 21

170

## Review Diagnoses

We have obtained a new symptom value and updated all candidate disease scores.  
 We need to review how this has changed the overall diagnostic complex, to see if we can/must terminate the loop or whether we can continue for another iteration.

2202

Review the cumulative scores and momentum variables of all Candidate Diseases.  
 Has one particular disease advanced (score) or is it advancing (momentum) significantly enough to select it directly for the next questioning?

Yes

2204

Set HAI/VAI to VAI for disease D.

2208

Set HAI/VAI mode to HAI

2206

**Review Diagnostic Goals (FIG. 23)**  
 Check if diagnostic loop goals or limits have been reached.

2210

Check if any Action Plateaus have been reached.  
 Allow the OS, other FO modules, or the patient to interrupt, pause, adjourn, repeat, or terminate the loop, or to modify any parameters, modes, or other control variables.

2212

Set Loop Continuation or Termination Flag(s)

2214

Return  
 with loop continuation instructions

2216

**FIG. 22**

2210

## Check Goals &amp; Limits

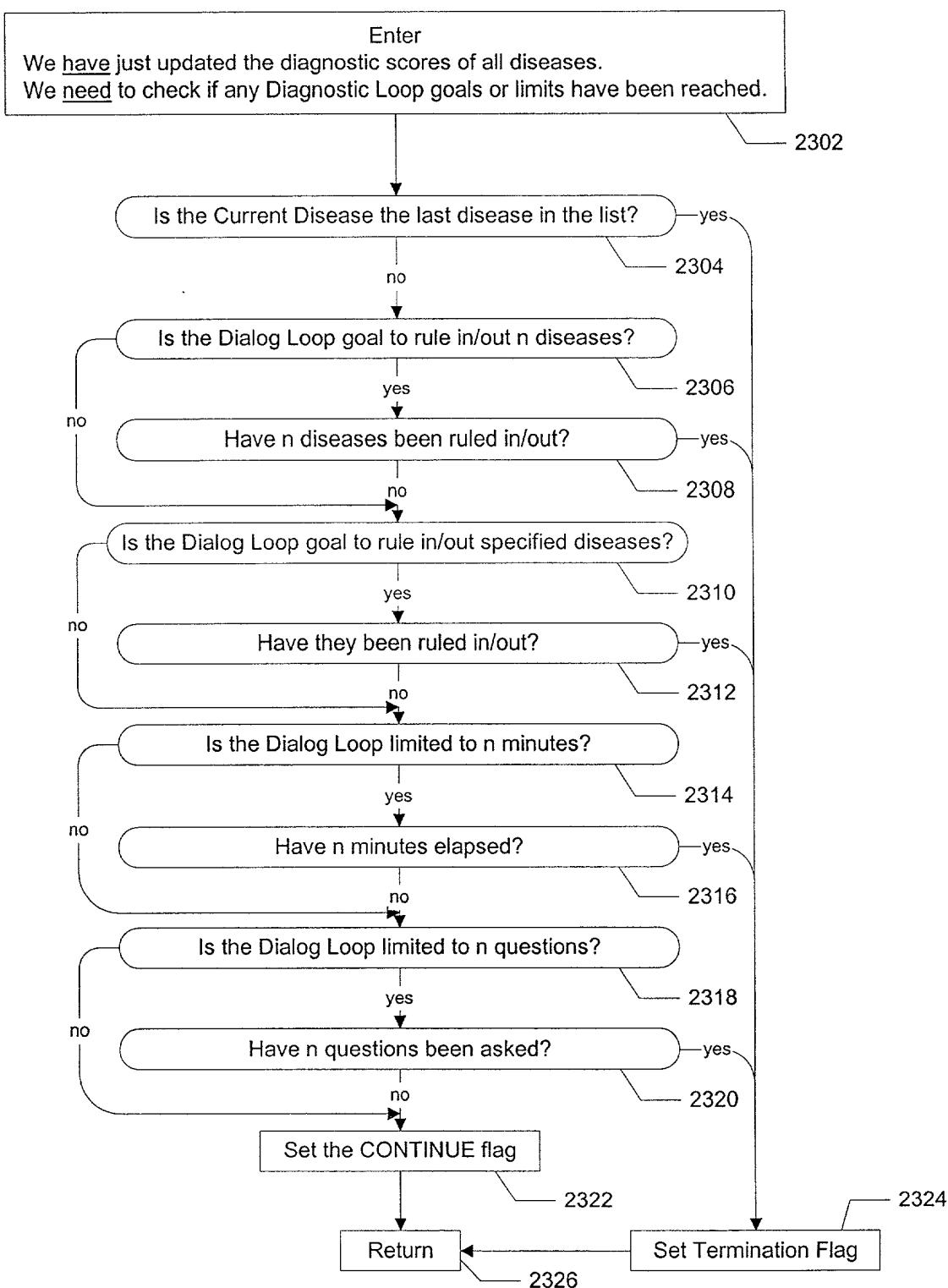


FIG. 23

Shut Down Diagnostic Loop

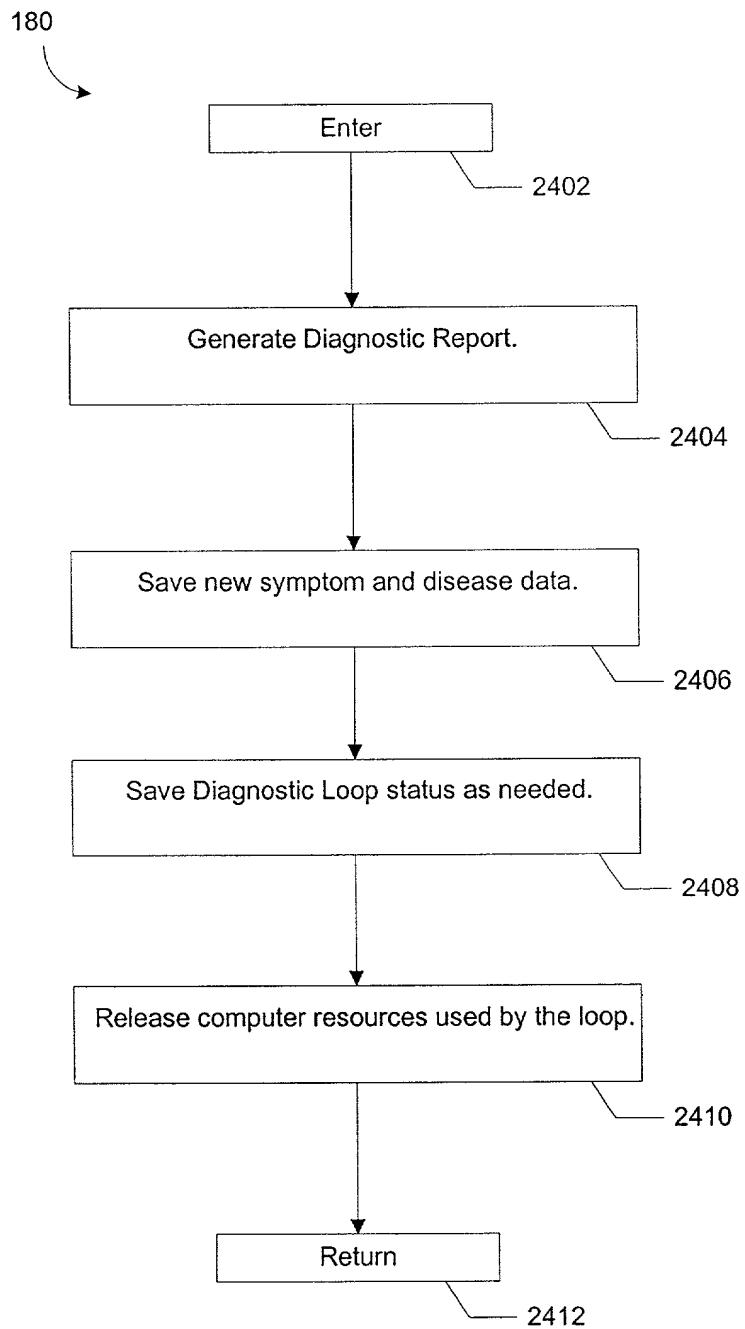


FIG. 24

## Symptom Object - SLOPE Method

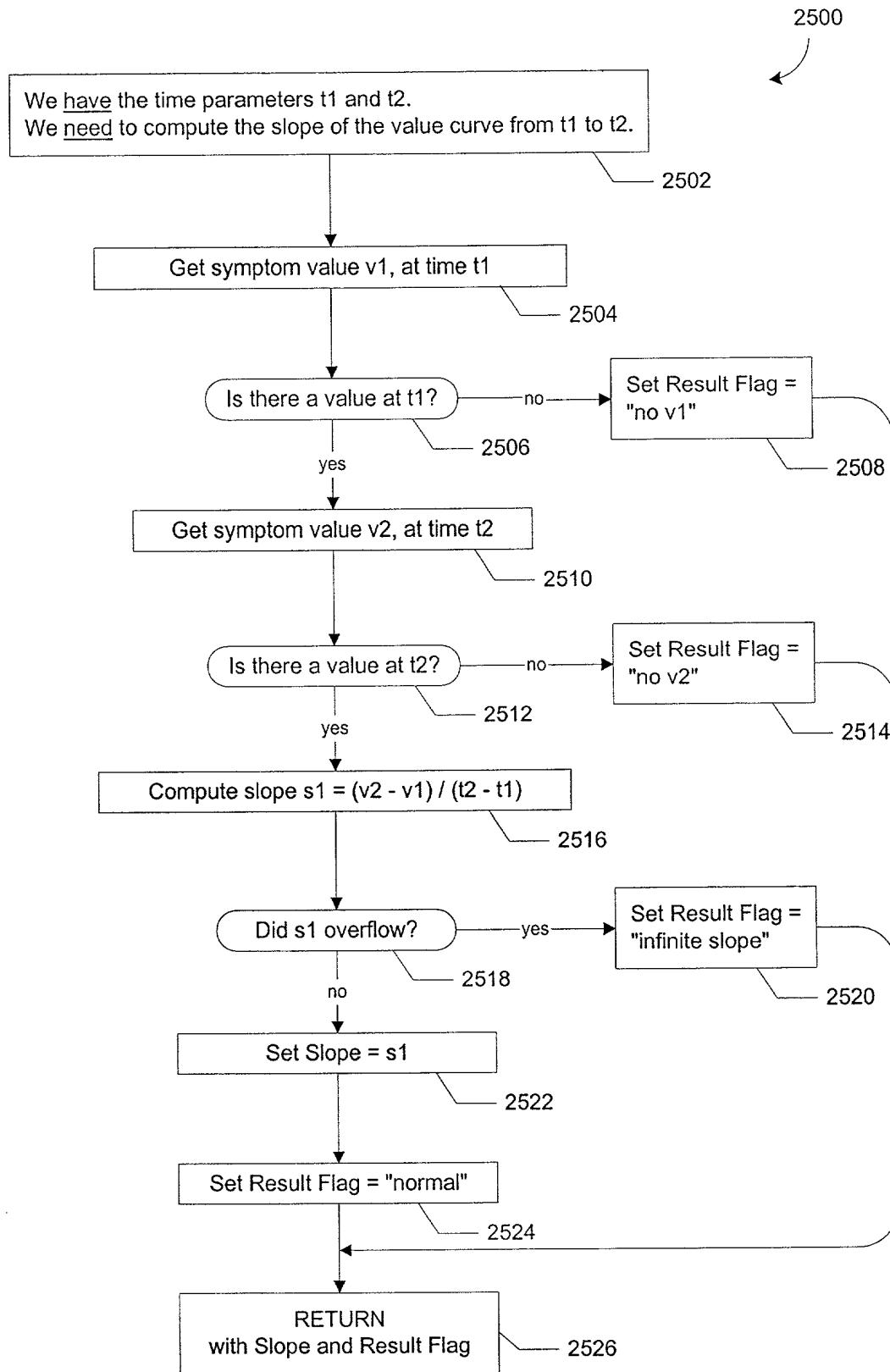


FIG. 25

## Symptom Object - TREND Method

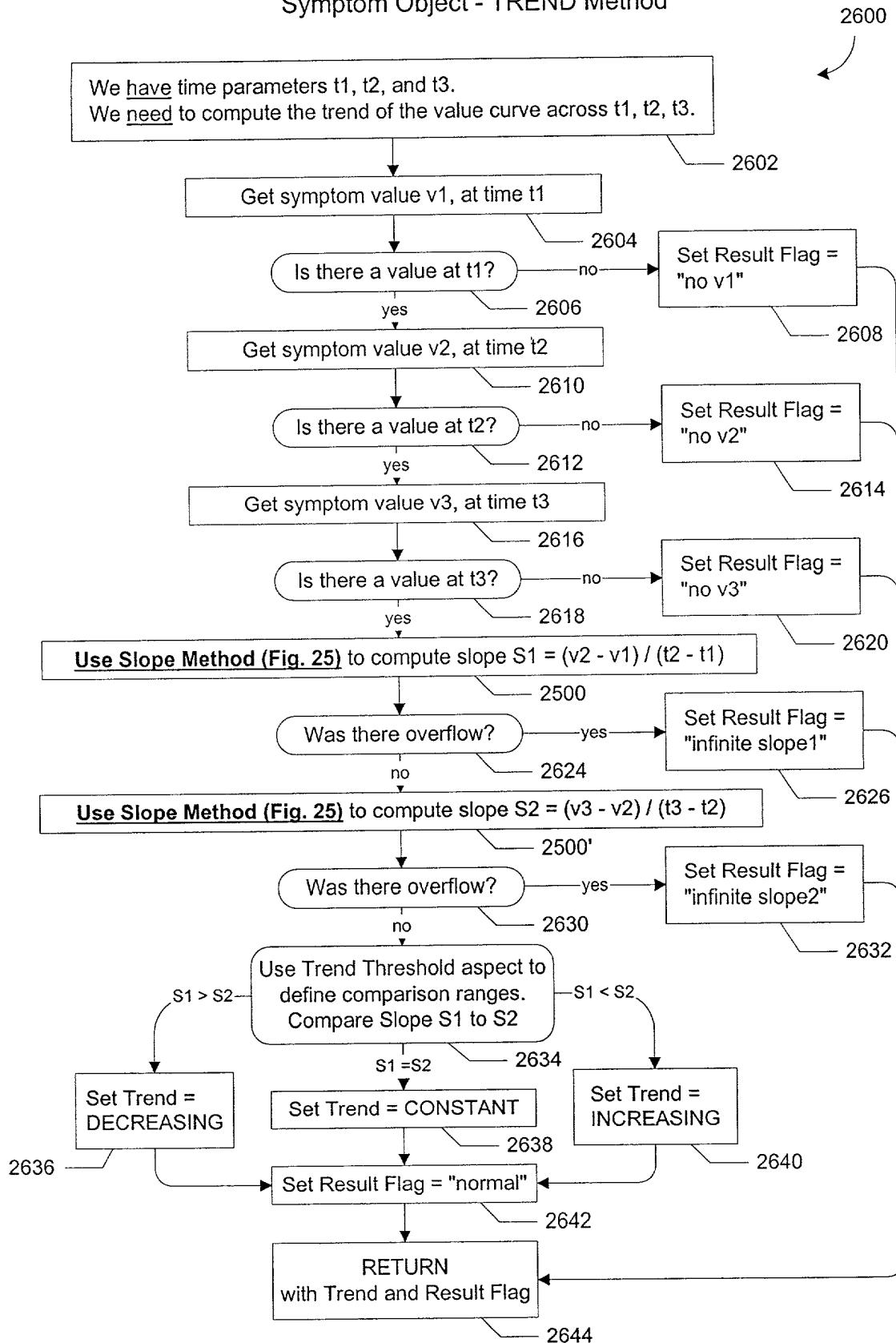


FIG. 26

2700

2702      2704      2706      2708      2710

HEADACHE DISEASE SYMPTOM MATRIX (DSM) SHOWING TWO COLUMN SCORING, SYNERGIES, AND HAI vs. VAI							
CONSULTATION BEGINS IN HAI AND ASKS QUESTIONS HORIZONTALLY, I.E., ACROSS THE ARRAY							
HAI MODE >>> HISTORY OF THE PRESENT ILLNESS (NOTE: IN HAI, SOME ACTUAL, SOME ALTERNATIVE)		COMMON MIGRAINE	CLASSIC MIGRAINE	CLUSTER HEADACHE	SUBARACHNOID HEMORRHAGE		
Throbbing pain?		30		25	-20	-30	
Nausea 1?			20	35	! -20	40	
Nausea 2?		35		30		35	
Nausea 3?		40		35		50	
Vomiting?			30	40	-20		25
Unilateral?		30		40		-20	
Prodromal?		40		50	-30		
Aura with visual changes?		10		30	-30	-25	
If you have an aura, is the headache on the opposite side?			10	30	0	0	
Photophobia?		25	30		-10	40	
Homer's syndrome?		0	0	50		-20	
Recurrent up to once a month?		20		20	20		-20
Recurrent in clusters?		0	0	50		-30	
AT THIS POINT, THE DSM MAY SEE THAT THE SCORE FOR CLASSIC MIGRAINE IS RAPIDLY ACCUMULATING AND THE SYSTEM WILL START ASKING QUESTIONS DOWN THE "ACTUAL" COLUMN FOR CLASSIC MIGRAINE							
VAI MODE VVVVVVVVVVVVVVVVV							
Family history of migraine?		30	40		0	0	
Feel "sick" afterwards?		40	45		-10	0	
Treated successfully with ergot?		20	40		20	0	
(NOTE: IN VAI ALL CLASSIC MIGRAINE QUESTIONS ARE ACTUAL)							
THE PATIENT COULD BE GIVEN THE CHOICE HERE OF GOING BACK AND RE-ANSWERING ALL OF THE QUESTIONS ABOUT CLASSIC MIGRAINE SUBSTITUTING THE "ACTUAL" LANGUAGE FOR THE ALTERNATIVE LANGUAGE. THIS IS NOT RECOMMENDED, BUT IN THIS WAY, NO MATTER WHAT DISEASE THE PATIENT HAS, IF IT COVERED, THE PATIENT WILL INTERACT WITH A DIALOG CREATED BY A WORLD CLASS EXPERT							
THE SYNERGY WEIGHTS ARE ADDED BELOW (NOT SHOWN)							
Simultaneous Synergies							
Sequencing Synergies							
Onset - Offset Analysis							
Summation Synergies							
•							
•							
•							
2750 → DIAGNOSTIC SCORE OF BOTH COLUMNS →		actual	alternativ	actual	alternativ	actual	alternative
		165	135	280	200	50	-70
						-60	75
2752 → DIAGNOSTIC SCORE TOTAL →		300		480		-20	15
THE DIAGNOSIS							
DSMhai3.xls							

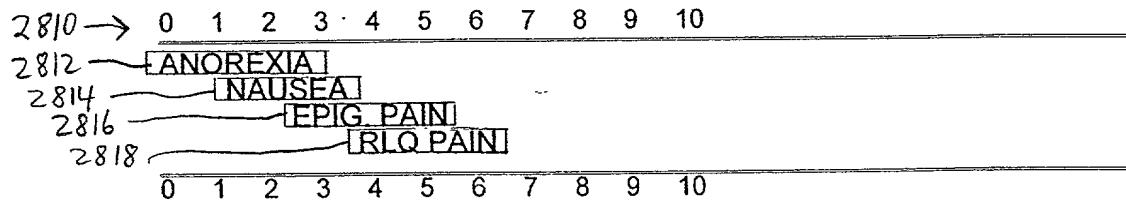
2714    2715    2716    2717    2718    2719    2720    2721

FIG. 27

Z800

This page demonstrates a type of question that lets the patient specify visually when a given set of symptoms occurred. The indicated Onset/Offset times are captured and used to adjust the diagnostic scores.

Time (hours) after First Significant Symptom



Use the mouse to slide symptoms left and right to indicate when they occurred

Z820

FIG. 28

## MDATA EMBODIMENT AS OBJECTS

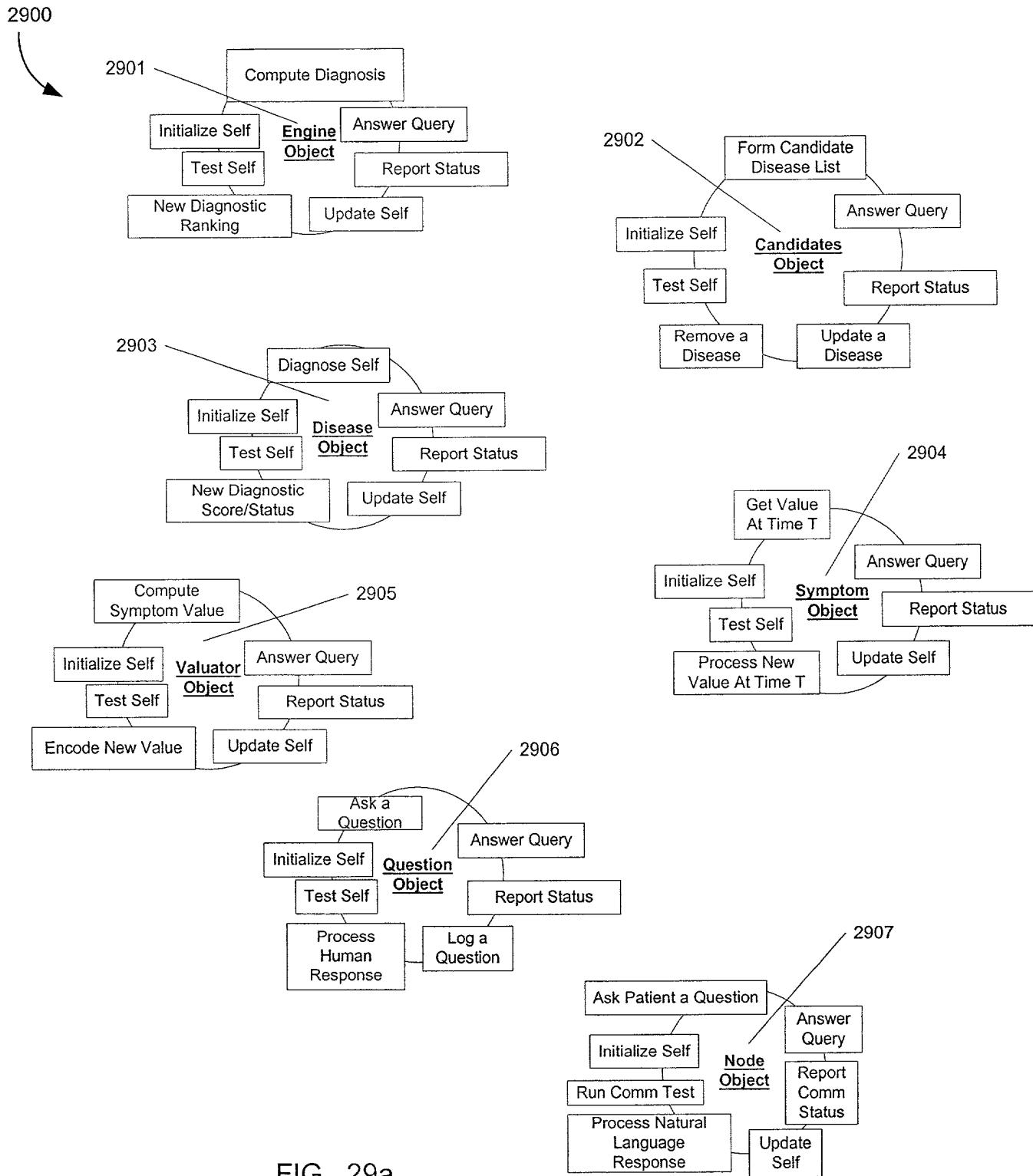


FIG. 29a

## USING OBJECTS FOR DIAGNOSIS

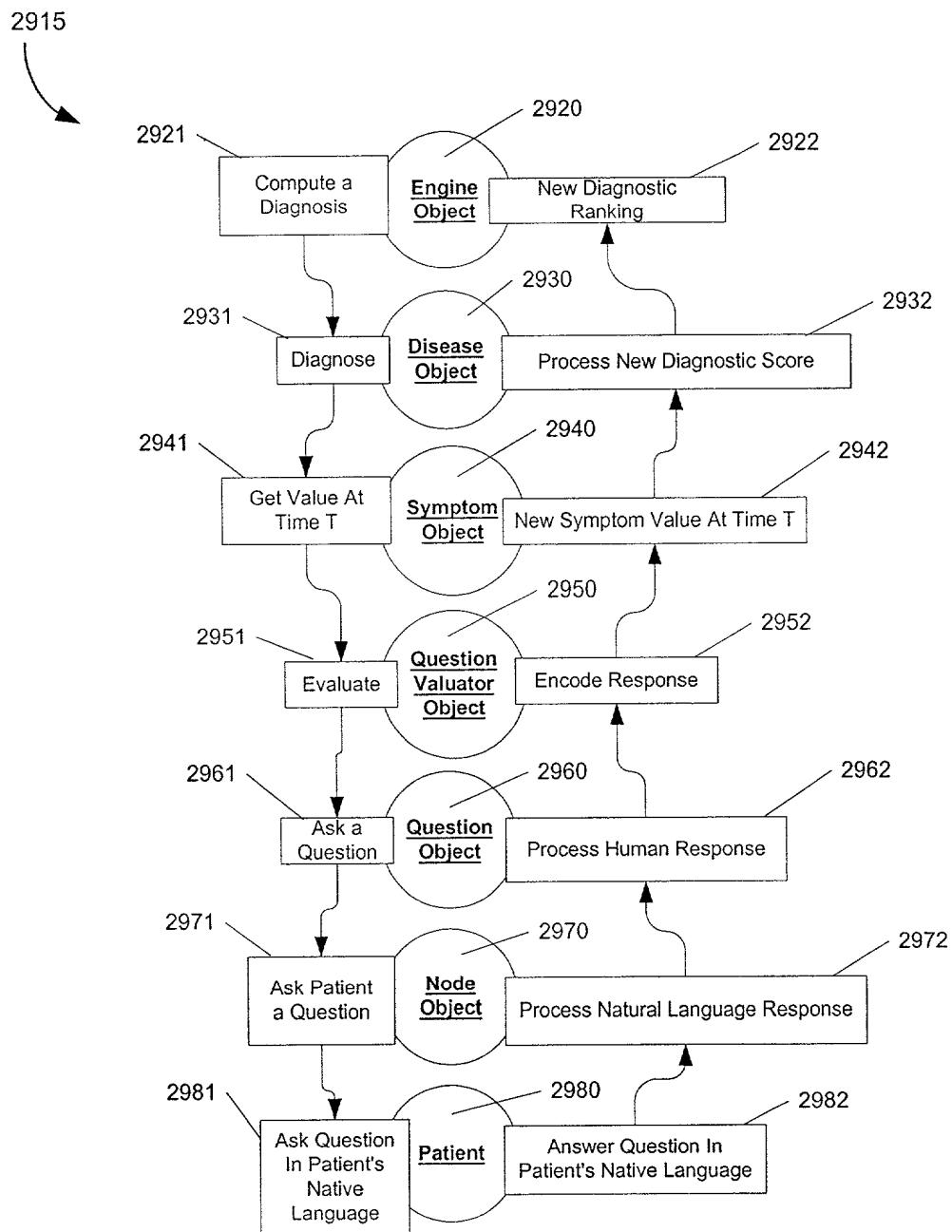


FIG. 29b

## ALTERNATIVE SYMPTOM WEIGHTS

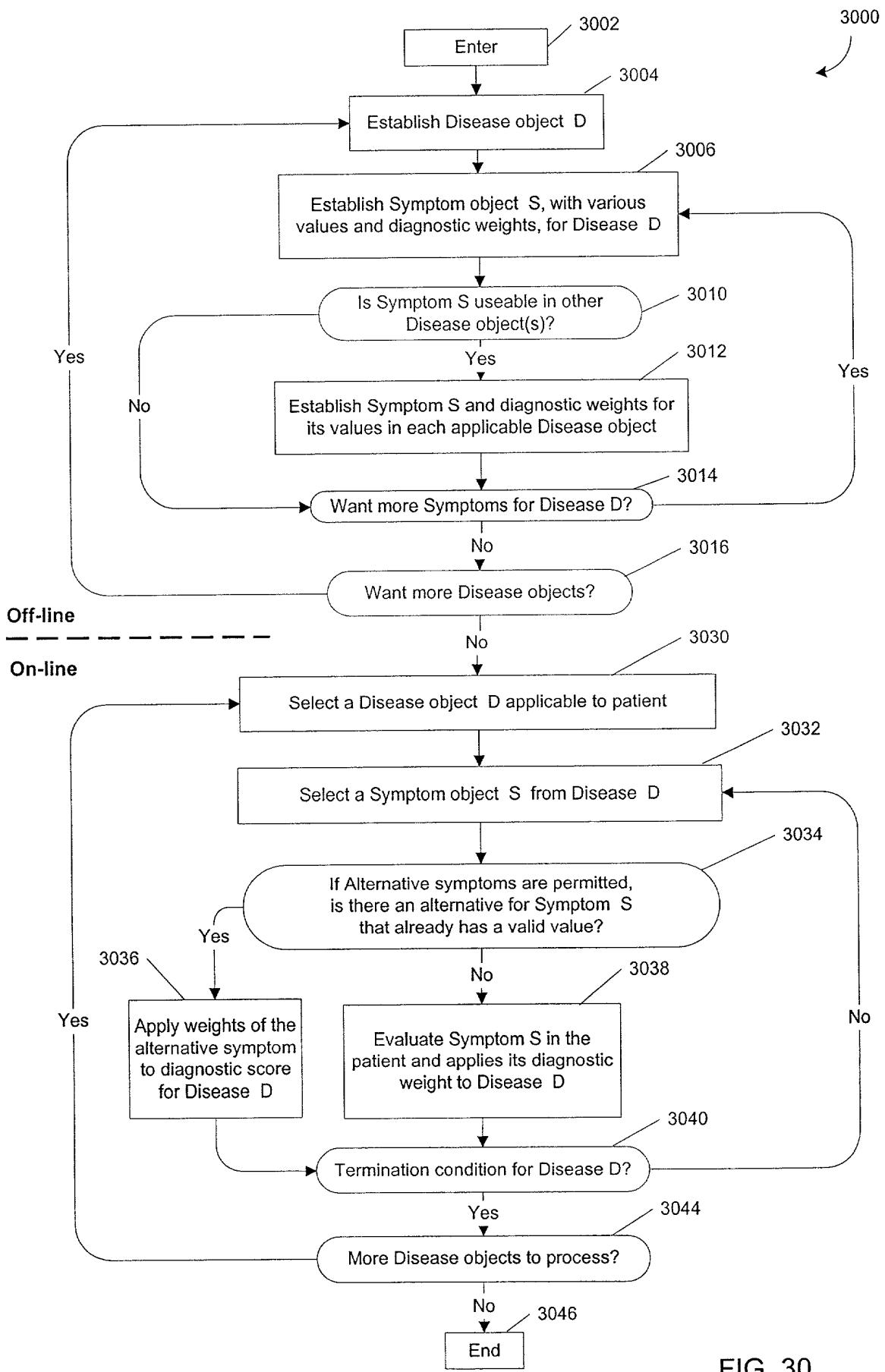


FIG. 30

## REUSE OF MEDICAL OBJECTS

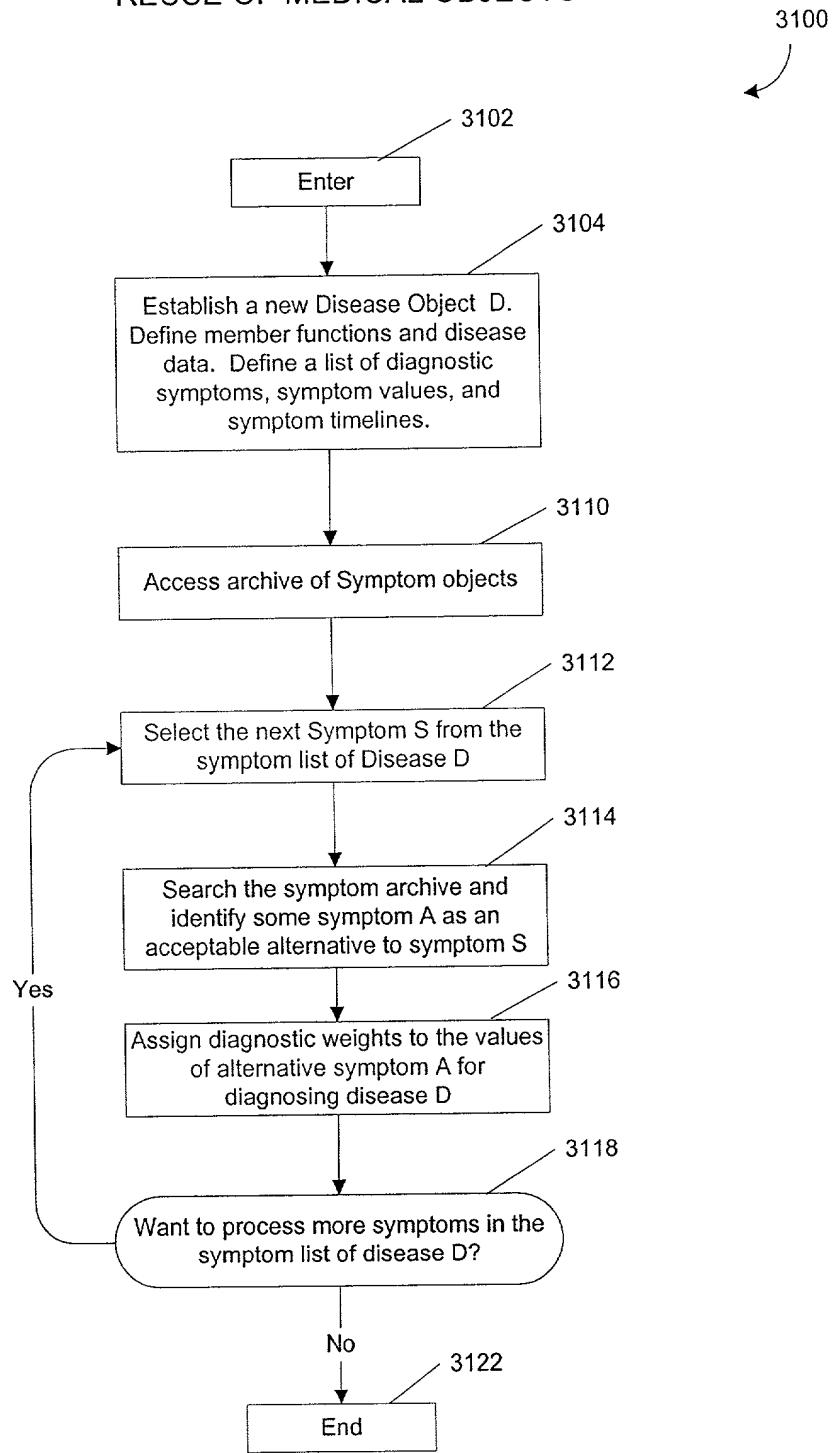


FIG. 31

## SET UP OF SYMPTOM ELEMENTS

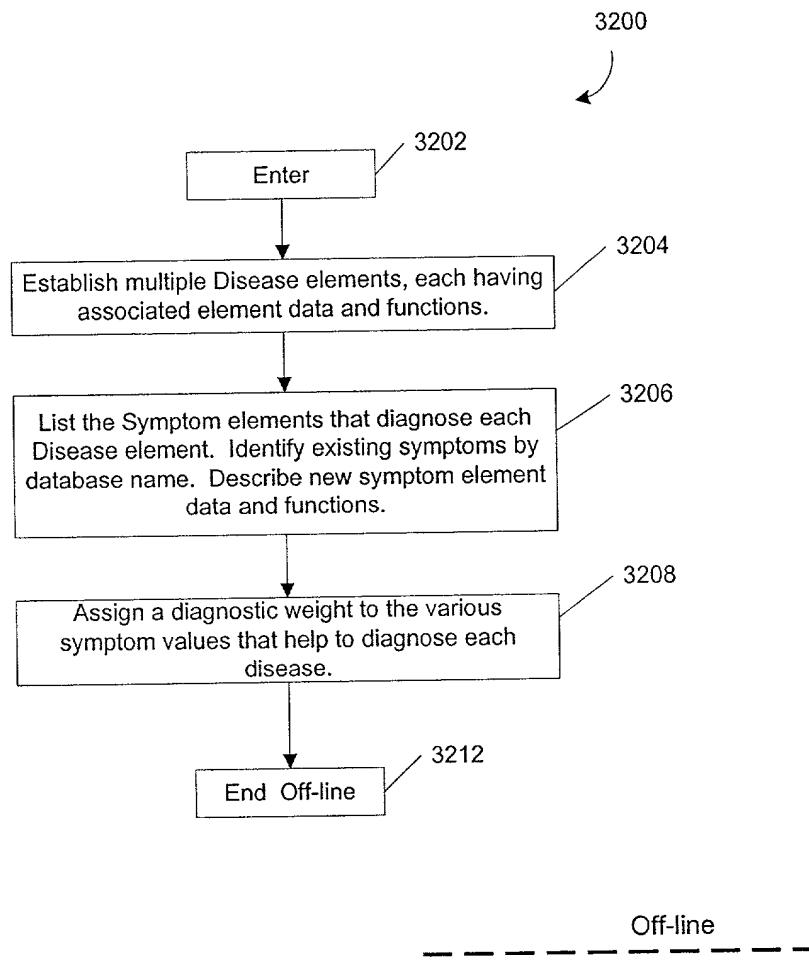


FIG. 32a

## USE OF SPECIFIED SYMPTOM ELEMENT(S)

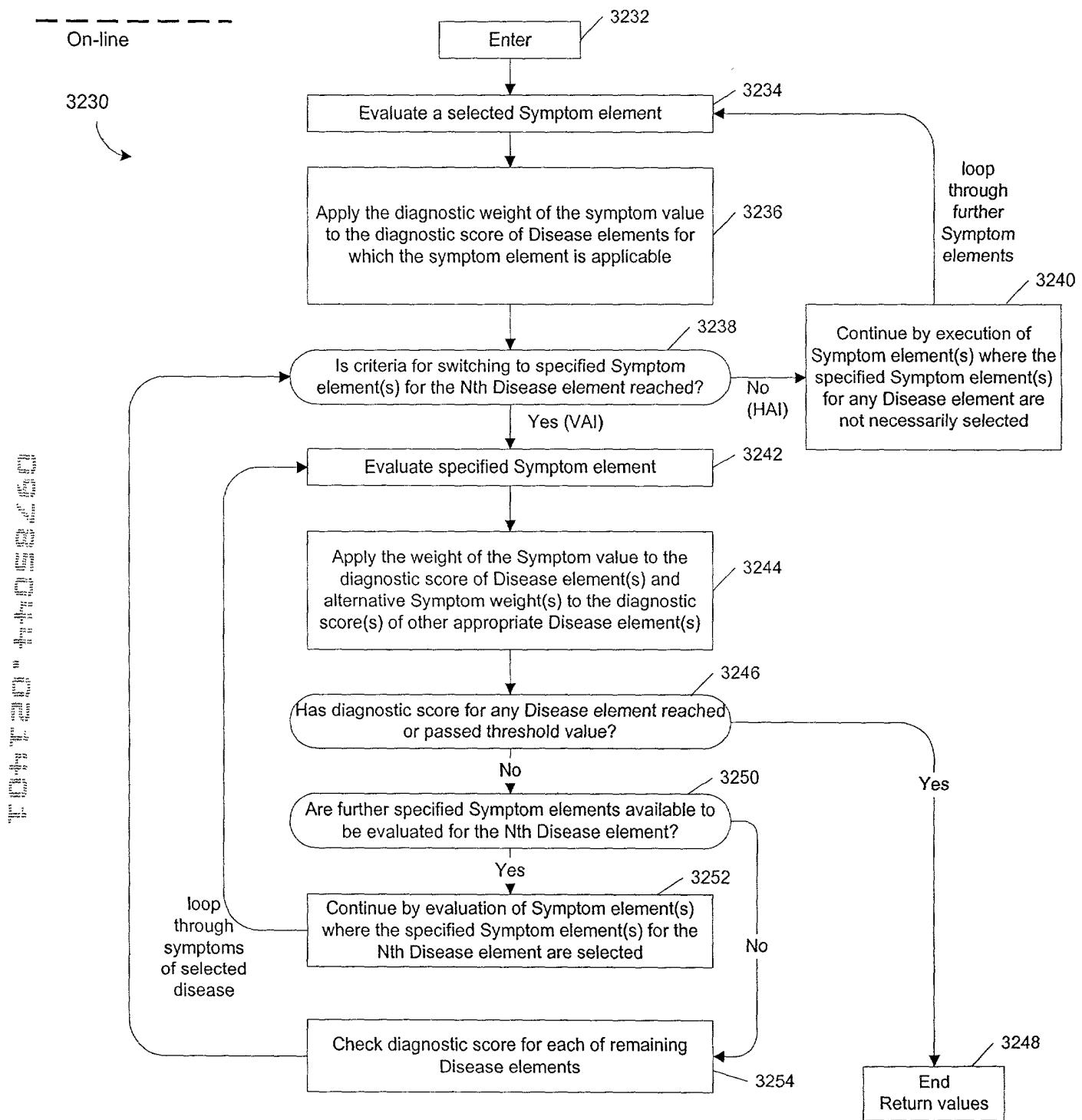


FIG. 32b

## DISEASE TIMELINES

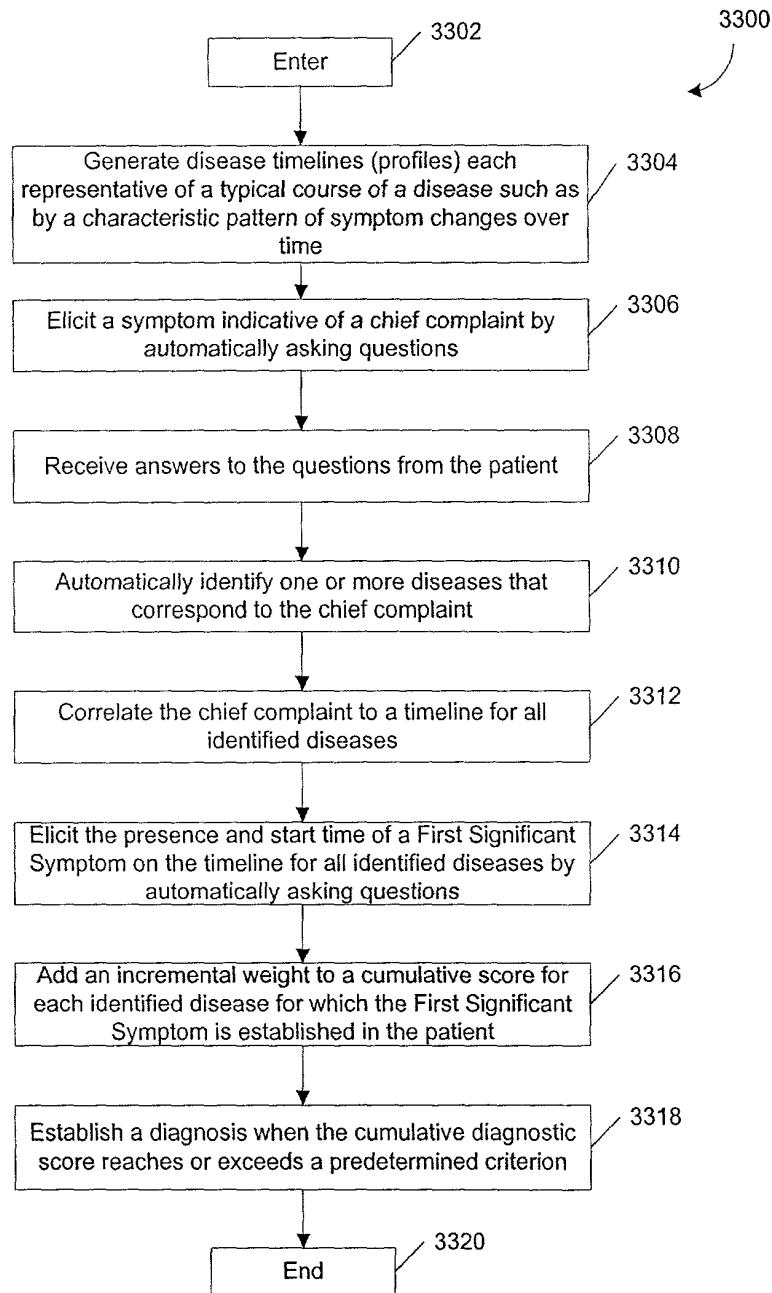


FIG. 33

## DISEASE TIMELINES

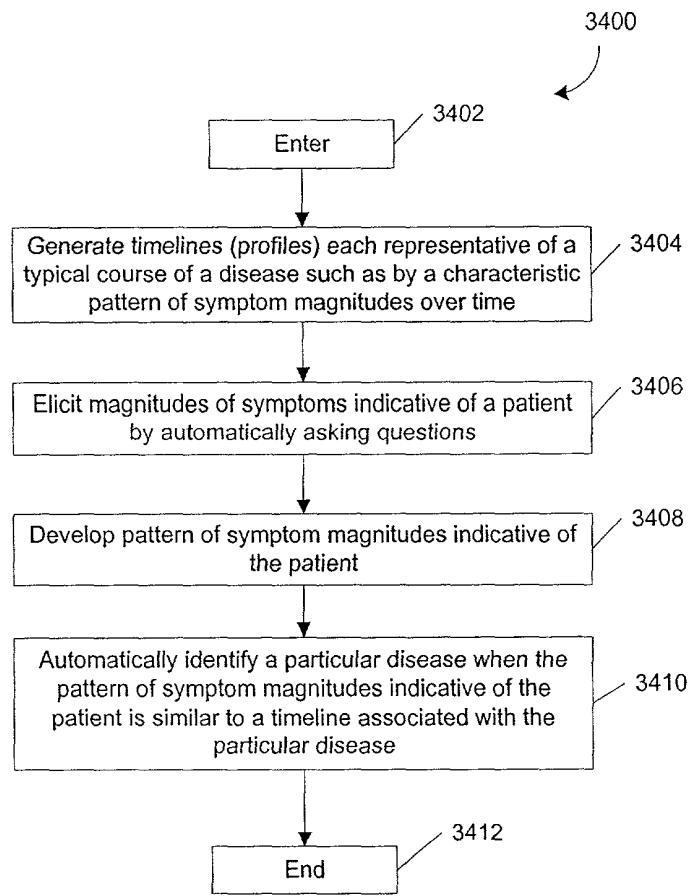
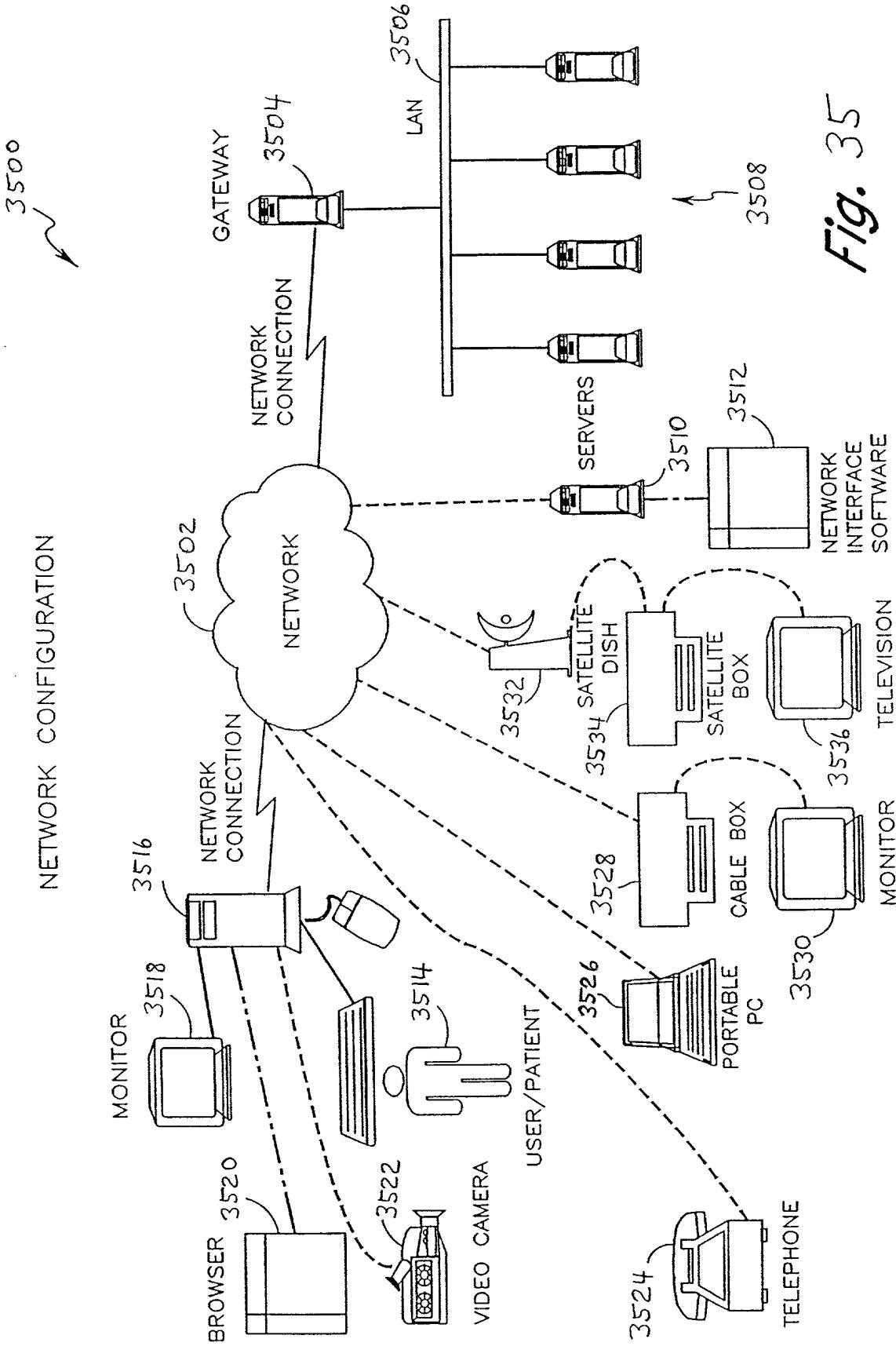


FIG. 34

NETWORK CONFIGURATION



*Fig.* 35